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WORLD CROPS

Agricultural Chemicals, Farm Supplies and Machinery

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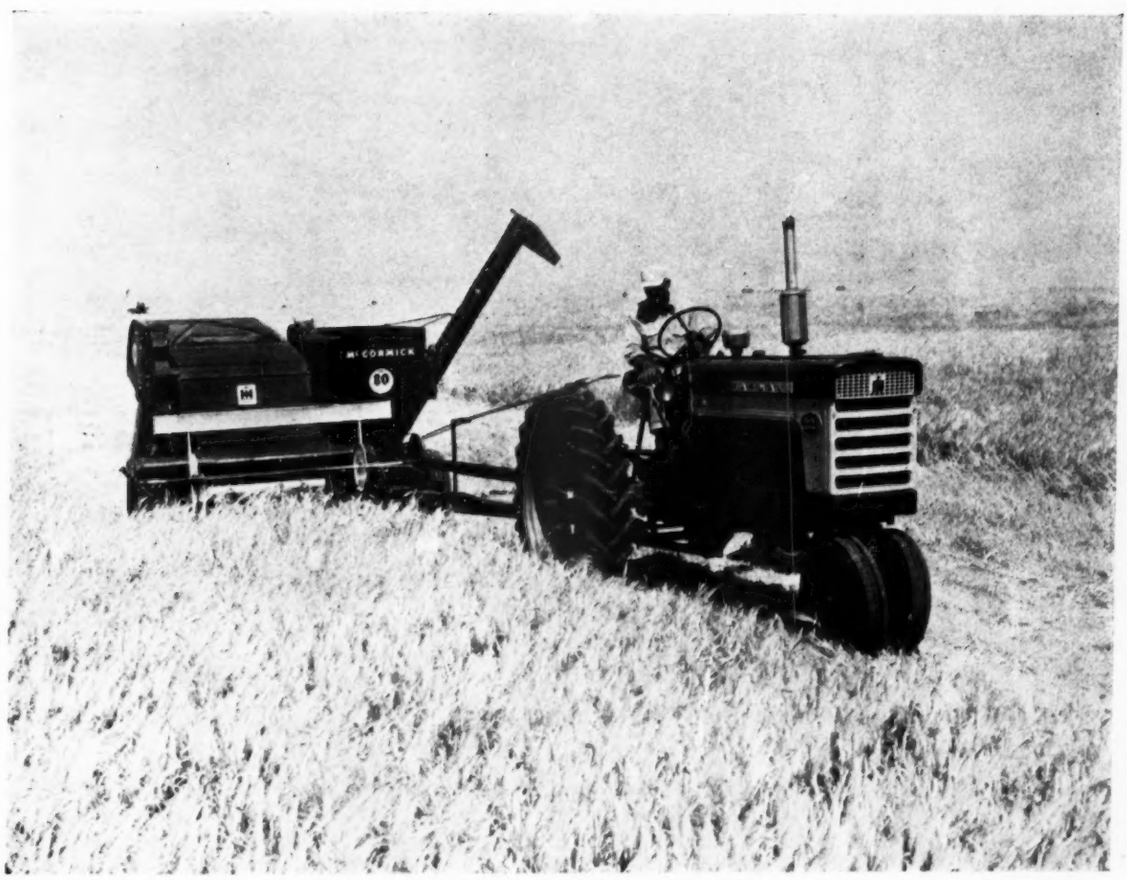

The McCormick International No. 80 — a high-capacity, tractor-drawn combine harvester with a 7 ft. auger-type platform — designed to meet the needs of farmers with medium acreages.

'All Clear' in Ceylon

Ceylon delights the eye with its shoreline fringe of dreamily-waving coconut palms — palms that are more than decorative. These slender graceful trees provide food and drink, coir fibre, copra, acetic acid, oils, timber and thatch for building. But they are also the target for rhinoceros beetles *(Oryctes rhinoceros)*, winged pests which, from refuse-dump breeding grounds, fly into the plantations and there bore into the crowns of the palms, attacking the young leaf shoots and growing points. Other organisms may enter into the bore holes and cause still further damage.

Keeping the plantation areas clear of decaying vegetable matter helps — but is not enough. An effective pesticide is also needed — one able to kill the beetle weeks after application. Dieldrin has proved ideal. Applied to the crown of the tree as a dilute emulsion it runs down and collects in the leaf axils, there protecting the palm's most vulnerable part from its flying marauders. For the coconut growers of Ceylon, dieldrin has sounded the "all clear". **dieldrin**

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Editorial Comment

Economics of Mechanisation

INCREASING MECHANISATION puts small farms at a competitive disadvantage because they cannot get full use out of all the different machines they require for an operation, and so they are forced to over-capitalise. It has been estimated, for instance, that full mechanisation on a 100-acre farm costs £50 an acre, compared with only £20 an acre on a 500-acre farm.

When operating a combine harvester it is most desirable to have a grain drier; bale sledges and bale loaders will increase the effectiveness of a pick-up baler; dung spreaders need to be filled by a hydraulic fork; and a forage harvester will require a team of trailers for its effective operation. Unfortunately, not all these machines and their auxiliaries can find full employment.

It is as much to the interest of the farmer as it is to the manufacturers of agricultural machines that his mechanical aids should be economically employed. One answer is the co-operative tractor and implement park; another is the employment of contractors, and the third is the machinery syndicate, the operation of which has been recently studied in detail by a Reading University economist. A short account of this work is given by N. Goodland on page 93 of this issue.

More Land For Food

THE PRINCIPAL CHANGE in agricultural policy in the U.S.A. during the past year has been the forced abandonment of the Soil Bank Programme, under which policy that country was able to produce, by private enterprise, *a vast unsaleable surplus of wheat from a greatly reduced acreage* by the fullest mechanisation of cultural and harvesting operation, by the use of modern methods of weed and pest control, by the correct use of fertilisers and, above all, by the production of higher-yielding and pest-resistant varieties of wheat.

In a most interesting article in this issue Mr. G. R. W. Dias has recommended the exact opposite in a most significant paragraph to the effect that '*it would appear necessary to bring more land under food crops to compensate for the low yields of rice* obtained at present and to keep pace with the increase in population'. While this may provide the quick answer to Ceylon's problem of feeding her soaring population, it is *not* the correct long-term answer.

Rice - A Major Crop

THE CORRECT ANSWER, we consider, is to make rice a subject for concentrated research by the establishment of a Rice Research Institute independent of the Department of Agriculture, without the time-consuming distraction of routine analyses, simple crop investigations and advisory work on minor crops and pests. An annual report can indeed be made to look impressive with the work done on minor crops and their attendant pests and the advisory work involved often demands extensive travelling to investigate relatively trivial matters.

The yields of rice in Ceylon are indeed very low, amounting, according to the 10-year plan, to only 32 bushels per acre. This, we consider, could be doubled. The remedy lies in the development of pure strains of high-yielding paddy, in the correct use of manures and fertilisers and in the correct management of the irrigating water. Such intensive methods are used in Japan and they can be applied in Ceylon too. The matter is urgent and, fundamentally, more important than any other of Ceylon's many problems.

Mechanical Aids in New Zealand

THE NEW ZEALAND farmer has never been backward in adopting new mechanical aids. From the earliest days of farming in his country he has been faced with the task of developing and farming large areas of land with a minimum of labour. Extensive use of mechanical aids has been the obvious answer.

His ready adoption and increasing use of mechanisation has had much to do with his attaining easily the highest output per unit of labour of any country's farmers. This, even in a country where labour costs are comparatively high, has led to low production costs.

But mechanisation has had other effects in addition to the obvious economic ones. It has meant relief for the working farmer and his family from much of the drudgery of the old days of labour and animal power.

Mechanisation also means speedier and more timely farm work, with lessened risk of losses due to bad weather, and often improved crop quality and yield. It can also mean a greater acreage brought under cultivation.

It also means extension of productive acreage by mechanically clearing and developing land that was previously regarded as an uneconomical proposition, such as the pumice lands of the North Island (see WORLD CROPS, 1957, **9**, 226, and 1958, **10**, 244).

Above all, mechanisation means shorter working hours, more congenial working conditions and greater prosperity and a better way of life for the farmer and his family.

The few years immediately after the Second World War saw spectacular development in mechanisation on New Zealand farms. The farm tractor really came into its own and with the widespread adoption of

equipment mounted on or operated by the tractor it became the accepted universal source of power.

Dollars for Deadly Daisies

EAST AFRICA'S marguerite-like flower, pyrethrum, is expected to earn $5,600,000 in the 12 months ending June 1960. This is the value of the insecticidal liquid extract and powder obtained from pyrethrum flowers which the U.S. is expected to import during that period, according to the Pyrethrum Board of Kenya, which acts on a co-operative basis for the European and African farmers who grow pyrethrum on the high plateaux of Kenya and the Belgian Congo. The pyrethrum flower crop in Kenya is expected to amount to 6,500 tons, with an estimated export value of the flower, or of the insecticide extracted from it, of £2½ million, of which exports to the U.S.A. will account for about £2 million.

The crop estimate of 6,500 tons is an increase of 2,450 tons, or more than a third over last year's actual crop. This year's larger crop, however, is less than planned at the beginning of the current period, adverse weather having restricted growth of the flowers.

To meet steadily increasing overseas demand from insecticide manufacturers the Board foresees a production in the ensuing year, by European and African farmers, of 8,000 tons of pyrethrum flower with an export value, mainly in the form of pyrethrum extract, of over £3 million.

Advisory Work and Research

WE HAVE LEARNED that the Rubber Research Institute of Malaya has recently established an extension service to give advice to planters on all aspects of rubber cultivation, thus relieving research officers of duties which must have seriously interfered with their normal duties. It is also planned to extend the organisation of advisory work to cover moderate-sized, generally Asian-owned, estates on the lines of the Smallholders' Advisory Service, which was established about 25 years ago. A detailed survey has already shown that such estates, sometimes badly in need of advice, are often completely out of touch with the Institute's research work. A Chinese version of the *Planters' Bulletin* is also to be published to assist the advisory officers in their work.

There is also a large area of rubber smallholdings owned by Malays. Malays are by no means illiterate and could be expected to benefit considerably by a version of the *Planters' Bulletin* published in their language. Such a publication would surely assist the work of the Smallholders' Advisory Service.

It is a curious fact that when Malaya was under British protection, an agricultural journal was published quarterly by the Department of Agriculture; now that the country has achieved independence and has appointed a Malay Minister of Agriculture it possesses no agricultural journal in the Malay language. We think that, as far as the major agricultural industry of the country is concerned, the Rubber Research Institute would render a service by publishing a quarterly journal in the Malay language also.

Footnote — Total rubber acreage in Malaya: 3¼ million acres; estates: 734,000 acres; smallholdings: 1¼ million acres.

Men with a Mission

THE INSTITUTE OF AGRICULTURAL ENGINEERS is a professional body similar in function to the British Medical Association. Among the duties it performs is the recruitment of new blood for the industry and, where necessary, it provides facilities for training.

Agricultural engineering is not an industry that often gets into the limelight like the aircraft, ship-building or motor industries, but it is truly wealth-creating. British agricultural engineering has not only provided for the majority of the needs of Britain's farmers, but since the war has quietly built up its export trade until in 1957, of its £130 million worth of production, £80 million worth was exported. This was more than the value of the exported aircraft (£70 million), ships (£64 million) and over half that of the exported motor cars (£152 million), according to the Abstract of Statistics, 1958, H.M.S.O.

In Britain there is the ever-present need to increase food production with a slowly diminishing labour force. This ' drift from the land ', as the loss of agricultural workers is often termed, is not a thing to be deplored, but applauded, since it is the principal means by which the standard of living of farmer and worker and, indeed, the nation can be improved. But it offers a constant challenge to all concerned with agricultural production – not least the engineer – to increase output per man and per acre by improved efficiency.

If the opportunities at home are great, those in other parts of the world, especially the tropics, are greater. It is estimated that the population of the world is increasing so fast that in the year 2000 it will be twice what it was in 1955, and even then 50% were near starvation level. Mechanisation can play a great part in increasing output from the vast under-developed potentials of Africa and Asia, but here the problems are different.

In the Western world we still have to improve designs and produce equipment more cheaply, but the social organisation is available to make efficient use of what is provided. The people of Africa and Asia are in many ways in the same position as we were in U.K. during feudal times, and so, besides developing mechanical techniques suitable for tropical conditions, those who seek to help must also have an understanding of the social problems. In all probability these will have a stronger influence than those of a purely technical nature.

These were some of the main points made by Dr. P. C. J. Payne, of Wye Agricultural College, in the course of a lecture given at the Royal Society of Arts. He concluded that the agricultural engineer, besides earning a livelihood, was, like the doctor, making a real contribution to the future welfare of mankind.

More Driers Needed

LAST YEAR'S experience - the long dry summer - was too reassuring to those farmers who grow grain as a sideline and still do not look on grain drying as a profitable proposition. The long period of bad weather in 1958 - now forgotten - showed all too clearly that the difference in the number of combine harvesters and driers installed on British farms is too great.

One farmer has got over the difficulty by installing an electric tunnel drier, adaptable also for drying baled hay. From mid-June to mid-July he dried 3,500 bales of hay – a total crop of 77 tons. With only about four good days for haymaking, the drier was in constant use and dealt with the bulk of his crop, and the cost, on average, was between 11*s.* and 13*s.* per ton.

Grain in sacks was dried later. Until the third week in September the average moisture content of the grain as put into the tunnel drier was between 22% and 25%. Every 24 hours the drier removed 2–3% of moisture from each 15–18 tons of grain until after four days the moisture was down to 15–16%.

Greenland Development

THE VERY name of their country must be a bitter irony to Greenlanders. Called Greenland by the earliest Viking discoverers in the hope of attracting settlers from Iceland and Scandinavia, the island is, in fact, one of the most barren and inhospitable in the world. Natural vegetation is limited to grasses and herbs and birch, willow and alder scrub. Agriculture is possible only on the narrow coastal strip in the southern part of the island, and it is indeed a problem to provide enough fodder to keep the very small number of cattle through the long, hard winter.

Denmark, we learn, is now actively assisting Greenland to develop her agriculture, horticulture and forestry through the medium of Den Kongelige Grønlandske Handel (the Royal Greenland Trade Department) of Copenhagen.

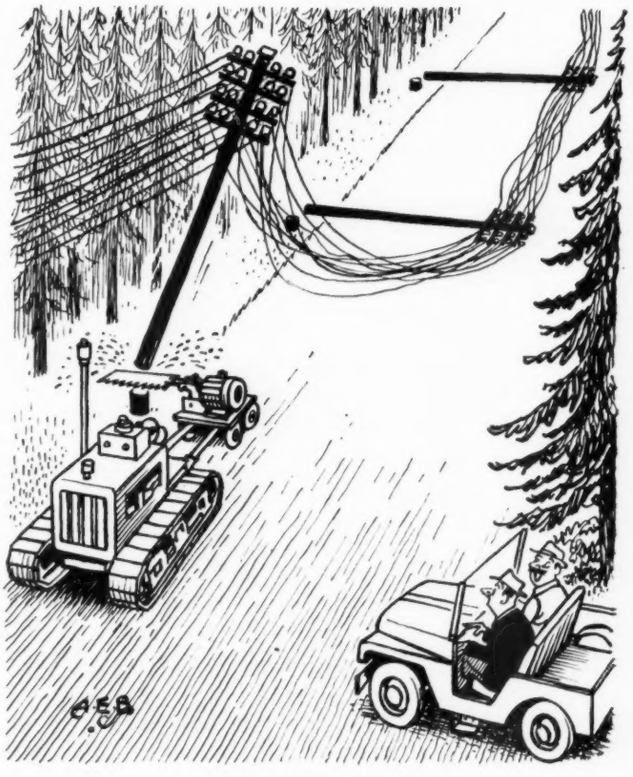
The annual reports of this department indicate that most attention is being paid to grassland, which is being improved by artificial irrigation and the application of fertilisers; low-lying areas are being drained and reclaimed and trials are being made with species of grasses from Canada, Finland and Norway. Hitherto the usual method of preserving the grass was by haymaking, but ensiling trials are now in progress. As well as the normal green crops, fish refuse and seaweed are being used for silage making. Attempts to feed cattle with fresh seaweed are showing promising results.

Chemical weed control, liming and fertilising with farmyard manure, seaweed, fish waste and inorganic fertilisers, as well as with trace elements, are steadily improving soil fertility. Many kinds of potatoes (including Primula and Arran Pilot), sugar-beet and turnips (including Yellow Tankard and Grey Stone), all important crops in southern Greenland, are being tested to ascertain which are the hardiest and best-yielding varieties. Trials of Scandinavian and Finnish varieties of oats and rye are also in progress. Horticultural activities are more limited, but crops are being grown in the open, under glass and in hot-beds.

Forestry trials were begun in 1953, using nursery plants sent from Denmark. Species used include Norway spruce, Siberian fir, Siberian larch, Sitka spruce, Scots pine, Engelmann spruce, a birch (*Betula neoalaskana*) and a hybrid poplar. The Greenland nurseries now contain about 30,000 plants.

Doom by Numbers

WE RECENTLY commented on the worsening problem of world population growth (WORLD CROPS, 1959, **11**, 305), but the position would appear to be even worse than we knew. Our gloomy prediction was based on a steady rate of population increase of 1.6% compound, when, in fact, there is more likely to be an accelerated growth of population, for, according to Dr. Brock Chisholm, a former Director of the World Health Organisation – who should know – ' world population in the next 41 years would increase more than in the



How's that for efficiency?

last 200,000 years '. This, indeed, is a startling and terrifying disclosure coming from such a source.

Preventive medicine is steadily reducing the death rate in many parts of the world, and increasing agricultural productivity may be expected to lead to improved nutritional standards in certain favoured countries. These two factors, operating in parallel, may be expected not merely to reduce the death rate, but also to increase human reproductivity, so that, at least for a time, world population growth is likely to show a progressive rate of increase.

How will this stop? Nature's own remedy to increase the rate of human mortality may take forms that are far from pleasant. Complacency in the overdeveloped* and well-fed countries, where the effects of increasing population are really only beginning to be felt, is not a solution, only an evasion of a very serious problem.

Merchants of Gloom

ACCORDING TO a leading national newspaper in Britain, ' The public is not dismayed by yet another merchant of gloom. It does not believe that ruin and starvation will accompany a rising birth rate . . . It is astonishing that men of science still have not learned what the humblest instinctively know: that the genius of man and the riches of the soil are inexhaustible '.

This is typical of the reassurances which do not offer any other solution than a policy of *laisser-faire* to meet a situation *unparalleled in human history*, for never before have efforts to alleviate physical suffering and disease been so universally successful, particularly in those countries where families of 15 to 20 are the target.

The efforts to increase world productivity are barely keeping pace with the increase in world population. It is true that there is over-production of wheat in the over-developed countries, but is it to be expected that these countries will be prepared to accept a lower standard of living so that the condition of the world's already starving millions can be alleviated, and even if it were feasible to distribute the surplus this is not a sound or a permanent solution.

Food must be produced where the mouths are and so planned efforts to increase agricultural productivity in the under-developed countries must be continued, but why should population be left as the one unplanned project?

Nature's Way

IT HAS been advanced that family planning is against nature, but all civilisation and, for that matter, all agriculture is against nature. To be natural we should not wear clothes; we should live in trees, we should scratch for roots and we should eat our meat raw.

According to present evidence, there is no reason to believe that the world-wide adoption of birth control would have biologically malign effects, according to Prof. P. B. Medawar, Jodrell Professor of Zoology and Comparative Anatomy at University College, London, giving the fourth Reith Lecture recently broadcast by the B.B.C.

There is, we submit, no reason to suppose that human quantity will increase human quality. On the contrary, the truth can be seen in those countries where family planning is practised and in some where it is not.

There are optimists who proclaim that we can produce adequate food for the yet unborn from leaves, grass, water weeds and the plankton of the oceans. We can also synthesise food, for have we not limitless energy in nuclear power? We can even find new worlds to conquer – but can we really envisage the movement, say, of some 500 million people to another planet, for that will be the size of the problem in the not too distant future?

Nauseating Vomits

A LURID ARTICLE in *Record*, the journal of the Transport and General Workers' Union, takes strong exception to a report on a new process for the extraction of edible proteins from vegetable matter.

' The lordly scientists (it begins) can't be bothered to go out of their way to create a demand for the nauseating vomits they work up for us. To them our tastes are economic frivolities, our appetites just indicate the need for more nourishment – an intake to be satisfied with a strictly utilitarian refuelling process . . .

' There is a long and fiendishly detailed description in the *Food Manufacture* article (October issue) of the process by which garden bonfire fuel, *i.e. grass*, is converted into tasty snacks '. The writer states that he is not the least bit happy about the prospect of saying grace after a meal of such products.

This aptly illustrates the ignorance and prejudice which needs to be overcome if efforts to meet the world's progressively growing requirements for food can continue to be effectively met. Every possible source needs to be explored – even grass.

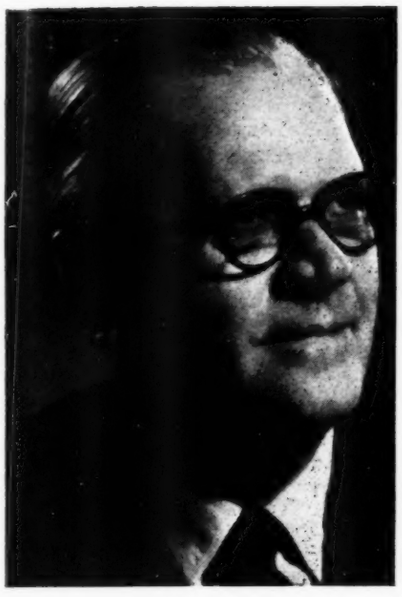
There is a disease called ' kwashiorkor ', in which the stomach becomes dilated and the legs wither. This our well-fed worker – ' who never had it so good '* – has never heard of. This is a disease of small children caused by protein deficiency, which grass juice can correct.

This all illustrates what is likely to obstruct those who try to do something to help the human race. Such people who do not appreciate that the hydrogenation of whale oil to produce margarine is just as ' artificial ' as the production of proteins from grass.

* Over-developed: countries where agricultural production of certain commodities is far in excess of demand.

*The state of Britain in 1959 according to Prime Minister Macmillan.

Towards Unity in Europe



Mr. Leonard C. Pearch, M.I.Mech.E., M.I.Agr., President of the Agricultural Engineers' Association and Vice-President of the Committee of European Manufacturers of Agricultural Machinery

While the original grand conception of a United States of Europe* has reached a state of 'sixes and sevens'†, the European manufacturers of agricultural machinery have already got together and formed a co-operative association.

Message from the President of the Agricultural Engineers' Association

WE, as a nation, are good at hiding our light under a bushel, and we in the agricultural engineering world are even better at this than most industries. How many readers of WORLD CROPS know what C.E.M.A. stands for? And yet the first annual general assembly of this association met during the Royal Show at Oxford last year.

C.E.M.A. represents an association of agricultural engineering associations from any of the countries of Europe operating under the title of 'The Committee of European Manufacturers of Agricultural Machinery'. Its aim is to learn to work together for the ultimate good of each, and so, through knowledge, understanding and co-operation, to forge a more efficient industry for the general good of the farmers of Europe and in this way open up greater prospects of trade the world over.

This aim is being implemented by rationalising trading conditions in Western Europe so that all agricultural engineering industries can compete in all markets on a basis of equal opportunity. The constitution has been written in such a way that it will never become a cartel.‡ It has no political connections and is intending to work in the closest possible co-operation with bodies such as the Organisation for European Economic Co-operation and the International Standards Organisation. Membership is open, through manufacturers' associations, to any national agricultural engineering industry in Western Europe. At present the member countries are Austria, Belgium, France, Germany, Holland, Italy, Switzerland and the U.K. The offices are in Paris, this year's president is an Italian and the two vice-presidents are German and English.

The task which C.E.M.A. has set itself is no light one. As a start it has formed five working groups, to which each country sends its experts. The groups are studying the following problems: (1) international fairs and shows; (2) nomenclature, terminology and statistics; (3) standardisation and joint planning of tests; (4) transportation from factory to user; and (5) technical questions (including protection against accidents and technical training).

Each member industry, *i.e.* each national agricultural engineering industry, has set up the same series of groups to advise and assist its delegates on the five working groups of C.E.M.A.

Great Britain has been active in forming the Committee because, in the long run, the markets of Western Europe will be an extension of our home market and the more we learn about it, and the sooner, the better. There is much to be done before the restrictions to trade which have grown up over the centuries can be removed, but we believe that our experience will show the way to other industries and so pave the way to greater European unity.

Although our aims might seem parochial when viewed against the wide horizon of world affairs, we are, along with our European colleagues, firmly of the opinion that one of the more immediate results will be the pooling of our knowledge and resources for the solution of agricultural problems in areas, less well placed than Western Europe.

L. C. PEARCH,
President, Agricultural Engineers' Association.

* Previous references: WORLD CROPS, 1958, **10**, 379, 393; 1959, **11**, 2, 205, 308; 1960, **12**, 3.

† 'Sixes and sevens': a state of confusion.

‡ Cartel: a union to fix prices.

Automation in Agriculture

A New Prospect in a Changing World

S. W. R. COX,* B.SC., A.INST.P.

AGRICULTURAL production is concerned with processes which are inherently subject to variations and uncertainties; nevertheless, the application of automation methods to crop and livestock production is receiving increasing attention in many places. In fact, the opinion of some engineers who are working on these lines is that almost complete automation of many types of agricultural production will be possible within another generation.[1]

Not so many years ago the word 'automation' was coined for the advanced automatic production methods of the motor industry. What are the prospects of automation in the agricultural industries of the world of today? Here is a review of the present position.

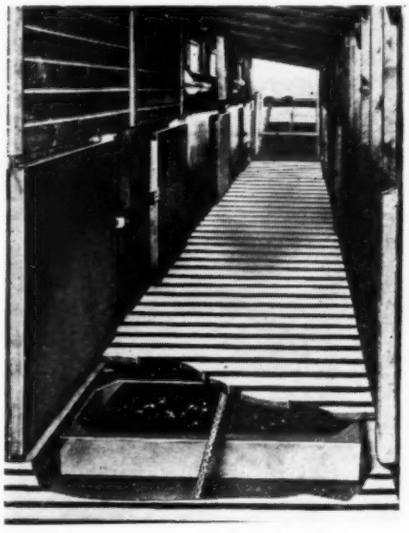
Installations for livestock

In a limited sense, automation is already with us in some sectors of stock production. The 'cafeteria' poultry system – incorporating automatic feeding, lighting control, cleaning and egg gathering – is an obvious example. In the rearing of pigs and cows, too, some processes have been rendered fully automatic. Two recent examples of this come from the U.S.A.

At the University of Illinois an electrically-operated pig-keeping installation has been devised for the study of feeding and cleaning requirements.[2] Among the storage methods used for feeding stuffs are flat-bottom storage bins with a specially developed unloading system.[3] This comprises an auger, sweeping round a central delivery point just above the flat floor of the bin and discharging into a small hopper below. The contents of the hopper feed into a second auger conveyor, delivering to the outside of the bin. A level switch on the hopper controls the operation of the sweep auger, stopping it when it is not required.

The various components of the feed are conveyed via a second hopper/switch unit to an automatic mixer and mill, which incorporates ingredient meters set to give the required mixture. A high-pressure pneumatic pipeline conveys the mix to the feeding area, where another hopper collects it and distributes it to the feeding trough via a further auger. Level switches on this hopper control the delivery of feed to the trough and can be used to control the output of the mill for a self-feeding regime.

A commercial installation which automatically provides a weighed amount of food to the pigs at fixed intervals. A predetermined quantity of water is sprayed over the food at the same time



Photos on this page: McMaster Farm Automation Ltd.

A dunging passage with slatted floor provides automatic dung cleaning and improved hygiene

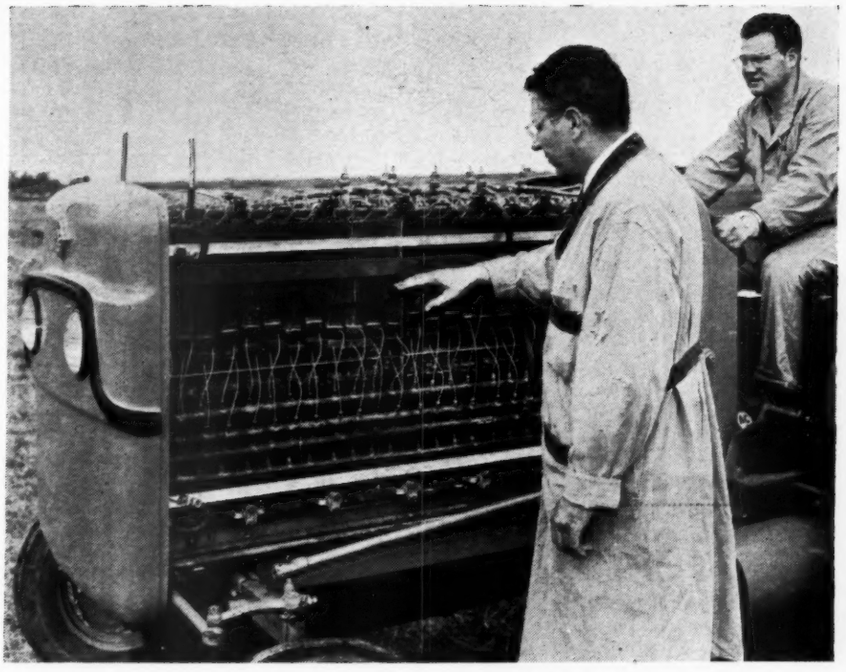
Alternatively, for limited feeding, the mill can be operated by a time switch. Safety devices are built into the system to deal with electrical overloads in the drive circuits and stoppages on the feed line.

An automatic cleaning system is installed over the circular exercise yard provided for the animals. Water from a slowly rotating boom carries manure down to a central drain. The water is pumped to the boom at high pressure from a storage tank. This system is controlled by time switch to operate at 2-hour intervals during the day.

* Head of the Instrumentation Department of the National Institute of Agricultural Engineering, Silsoe, England.

The Agricultural Engineering Department at the University of Vermont has a fully automatic feeding unit for cows in stalls.[4, 5] This takes silage from a tower silo, adds feed from a preset mixer and mill, and carries an individual ration to each cow.

To feeding systems such as this can be added the mechanised equipment available today for milking, recording, stockhouse cleaning and circulatory washing and sterilising of milk pipelines – which brings together some of the elements of the automated milking process predicted for the future.



The Allis-Chalmers Manufacturing Co. has installed 1,008 propane-mixture-fed cells in an engineless tractor. Chemical reactions produce 15 kW of electricity – enough to provide the tractor's 20-h.p. electric motor and produce a drawbar pull of 3,000 lb.

Automatic tractors

Turning from static installations to farm vehicles, much wider possibilities for automation present themselves. These centre mainly on the development of automatic guidance systems for the farm tractor in farmyard and field, for if these can be made practicable and economic an important step has been taken towards the automation of crop production and robot performance of many farm operations.

Over the past few years several developments in automatic guidance and remote control of tractors have been reported from various parts of the world. Not all of these are intended to dispense with the continuous attendance of the driver. Rather, some have been designed to reduce driver fatigue by rendering the steering automatic on continuous runs. Nevertheless, the methods employed in these cases have relevance to the development of complete automatic working.

Feeler-control systems

An automatic pilot reported from the U.S.A. last year follows these lines.[6] Automatic steering is controlled from a pivoted, front-mounted probe pointing forward of the tractor and carrying two long antenna-shaped feelers. When dealing with row crops the tips of these feelers closely straddle the plants. Deflection of the feelers to one side or the other by a predetermined amount brings into operation a corresponding pressure-sensitive switch mounted near the pivot point. This sets in motion an electric motor which acts on the steering drag link. As a result the wheels are turned in the correct sense to counter the deflection of the probe. The steering is automatically straightened up as the feelers are returning to their central position. In this way, overshoot is restricted.

The factors which had to be considered in connection with stability and accuracy of guidance were the rate of adjustment of the tractor wheel angle and its relation to the feeler displacement, the forward position of the feeler tips and the deflection allowed before corrective action was initiated.

This system is adaptable for furrow or windrow guidance and has worked in row crops at 6 m.p.h. Manual operation is readily restored for turning.

A very similar development, which passed tests in the U.S.S.R. in 1958, has been described recently.[7] This was devised for ploughing with a tracked vehicle. A front-mounted framework carries an offset trailing arm, which ends in a stirrup-shaped follower. This, when linked to a chain, runs in a furrow. As in the preceding case, lateral deflection of the follower operates a corresponding left or right-hand switch at the pivoted end. Each switch controls an electrically-operated valve to set in motion one of two hydraulic rams. These rams act on the steering clutches and so guide the vehicle.

To operate the system the first furrow must be ploughed under manual control. The driver then sets the follower in the furrow, switches to ' automatic ', selects a gear, dismounts and engages the drive with an external lever. In spiral ploughing the guidance mechanism will, of course, continue to operate unaided. It was reported that some tractors to be built in 1959 would incorporate this system.

Radio-control systems

In contrast to these methods are the radio-control systems. In Britain the Ford Motor Co. demonstrated this principle in 1955,[8] using a transmitter to send out a radio-frequency signal upon which could be impressed one of six different tones. Each tone represented an order to the tractor: left or right steer, operate clutch, raise or lower implement and stop engine. Tuned relays in the tractor receiver unit responded to each of these tones and initiated the control mechanisms. Power control was supplied by an engine-driven oil pump, control valves and hydraulic cylinders. Later, on a private farm, the transmitter was mounted in another tractor and one man operated the two machines in the field.[9]

A similar tractor was demonstrated in Australia in 1956.[10] The inventors of the machine then drew attention

to its possible use in bush fire fighting, to carry forward fire-fighting gear or to carry out bulldozing operations. This point – – the ability of the remote-controlled or robot tractor to work in conditions hazar ous to man – – has been noted in connection with the spraying of toxic chemicals in the field.

In general, the radio-controlled machine can render many farming operations more comfortable for the operator by placing him in the control station while the tractor does the work. The disadvantages of this method as it stands, however, are that operator control is still needed all of the time and that some kind of visual aid may be necessary at long range or in conditions of low visibility.

Programmed operations

There is a much greater gain if the tractor can be ' programmed ' to follow a predetermined path and then left to get on with it. Work on these lines is going on in Britain and, in fact, the Reading University Farm Mechanisation Department, in collaboration with the British Electrical and Allied Industries Research Association, has already demonstrated a driverless tractor carrying out preset tasks unaided. Its route was defined by an underground cable carrying an alternating electric current and it followed this course with the aid of forward-mounted pick-up coils. Other sensing coils picked up operational signals at selected points on either side of the main cable and these were used to initiate the appropriate action. In this way the machine was made to obey traffic signals and to carry out the distribution of fertiliser and hay bales in conjunction with suitable trailers.

The potentialities of such a system for carrying out routine farm transportation of various kinds are clear. For automatic field work other guidance methods are more appropriate and current development projects are concerned with the form that these should take.

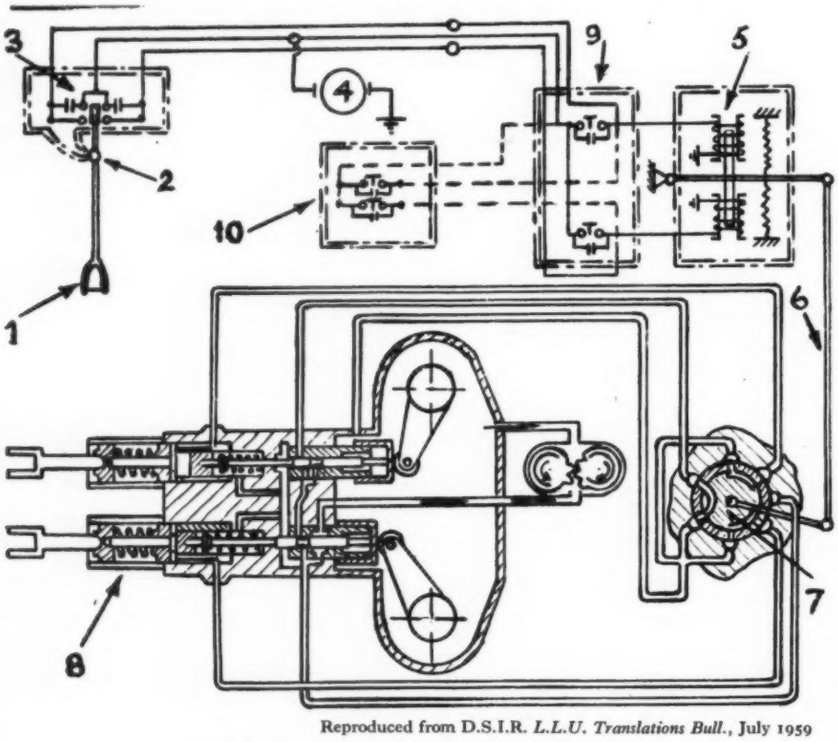
Self-navigation methods

At this point a very simple method of automatic guidance can be mentioned. This was devised some years ago by a farmer, Mr. E. A. Cory, of Cheltenham,[11] who caused a tractor to follow a spiral track by tethering it to twine wound on a fixed reel, with a suitable attachment to the steering mechanism. The diameter of the reel was made adjustable to vary the pitch of the spiral according to the width of the trailed implement.

Further development of such a technique is possible, but a less restricted, self - navigational method is being sought in general. This will require that the tractor is able to determine its own position with the aid of some external reference and to correct for departures from the mapped course. In addition, it must use its positional information, together with data collected from suitable sensing attachments, to control the operation that it has been set to carry out.

The type of tractor to be used also comes into this calculation. Its speed and draught must be simple to control, from which it follows that the use of hydrostatic transmission seems likely. However, the recent development of an experimental fuel cell tractor, produced by the Allis-Chalmers Research Division, may signify that electric traction is to be reckoned with for the future.

These, then, are some of the possibilities now under consideration for the tractor of the near future. Their ultimate achievement will depend not only on the cost and technical limitations of the navigational and operational systems developed, but also on the frequency of breakdowns from all causes which require the intervention of (by this stage) highly specialised servicing staff.



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Electrohydraulic Steering Control

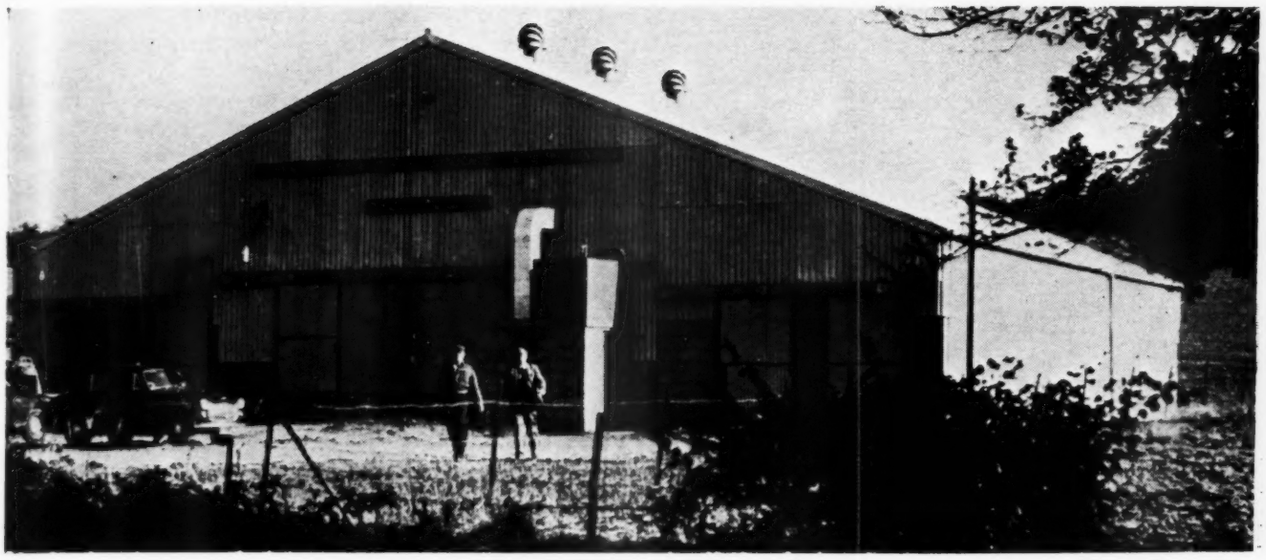
1. Follower. 2. Pivot. 3. Two-way switch. 4. Generator. 5. Two-way solenoid. 6. Mechanical linkage. 7. Rotary hydraulic control valve. 8. Hydraulic control valve. 9. Push-buttons for manual operation. 10. Remote-control buttons. The tractor can be driven by an operator on a trailed machine or implement, using push-buttons for steering, main clutch and engine governor control

Pilotless planes

Another possible application of remote control to field work arises in connection with the aerial treatment of crops. When a conventional aircraft is used in restricted spaces the strain and hazard to which the pilot is subjected are well known. So also is the high cost of these operations. In this light, the idea of pilotless aircraft with a high ratio of payload to overall weight is attractive, a point made in this journal last year (see WORLD CROPS, 1959, **11**, 379).

In fact, the development of small, manoeuvrable flying machines, operated from the ground, has been discussed. Although doubts have been cast on the existence of a market sufficiently large to justify their mass

(*Continued on page* 95)



A grain-drying store belonging to the 11th Hampshire Syndicate, consisting of eight members

Farm Machinery Syndicates

N. L. GOODLAND*

This is an account of the organisation and operation of farm machinery syndicates in Britain, which will be of immense value to smallholders, market gardeners and small farmers in other countries (see WORLD CROPS, 1959, **11**, 239).

THE articles of association of Syndicates Credits Ltd., a non-profit-making company, limited by guarantee and having no share capital, were drawn up for the Hampshire branch of the National Farmers' Union and incorporated on 8 June, 1955.

Objects

The objects of this movement were to buy farm machinery by means of farmers' syndicates as laid down in Rule 2:

> 'The acquisition and ownership of machinery for the use of syndicate members on their own farms. The word "machinery" to include all agricultural and horticultural equipment, fixed or otherwise; implements, tractors, trucks and lorries'.

Method

A machinery-buying syndicate, having been accepted as 'credit worthy', may consist of two farmers or more. On approach to Syndicate Credits Ltd. 80% of the cost of the article may be loaned, the remaining 20% to be paid by the syndicate on delivery. The loan, so made, is paid off in half-yearly instalments, with interest payable only on what is outstanding. Loans for movable equipment may be paid off over four years and this may be extended to five years in the case of grain-drying, storage and cleaning plants.

Further costs are made up as follows: Syndicates Credits Ltd. are charged 1% on money borrowed and also an initial levy of £2 per syndicate member, which goes back to the Agricultural Central Co-operative Association to cover the cost of administration.

Syndicates Credits Ltd. are also charged for loans ½% above bank rate. The syndicates themselves are charged a further 1% to cover the county's administrative costs. Thus the rate of interest charged to each syndicate is 1½% above bank rate, between the limits of 5% and 7%, calculated on outstanding balances only.

Examples

The Ministry of Agriculture, Fisheries and Food gives the following example to make the initial cost clear: three members of a syndicate buying an implement for £500 would have to find 20% = £100; 1% of the remaining £400 = £4; £2 per head levy = £6; a total of £110. The method of repayment of loan, apart from dates agreed with Syndicates Credits Ltd., is the internal affair of the syndicate.

Here is an example of such repayment by the second syndicate to be formed in Britain. Four farmers, A (304 acres), B (140 acres), C (230 acres) and D (80 acres), bought an 8-ft. 6-in. Massey-Harris bagger combine and a high-volume 150-gal. 'Fieldmaster' sprayer. For repayment of loan, and contribution to the initial deposit, cereal acreages were taken into account. They were: A, 60 acres; B, 50 acres; C, 45 acres; and D, 25 acres.

It was decided that payment for the combine harvester should be based on units of one per 20 acres. Therefore A paid for 3 units, B for 2½, C for 2¼ and D for 1¼.

* Agricultural correspondent, Hampshire, England.

In regard to the sprayer, it was agreed that A, B and C should pay equal amounts and that D would pay one-third of the amount of any one member.

Method of repayment

The figures in Table 1, taken from the records of the second Hampshire syndicate in regard to repayment of loan on the sprayer, illustrate how the system works.

Table 1

	£	s.	d.
Cost of sprayer, £300			
First year, syndicate's deposit	60	0	0
1% initial charge, £240	2	8	0
First half-year, capital repayment ..	30	0	0
Interest at 6% p.a. on £240	7	4	0
Second half - year, capital repayment	30	0	0
Interest at 6% p.a. on £210	6	6	0

This continues to the eighth half-year, each members' individual subscription having been agreed before purchase.

In most cases of machinery purchase by syndicates, a servicing arrangement is made with the dealer before purchase. The servicing engineer reports on wear and on workers' maintenance. Servicing comprises collection, winter storage, cleaning, greasing and re-delivery in time for work by contract. The inspections are six-monthly.

Fixed equipment

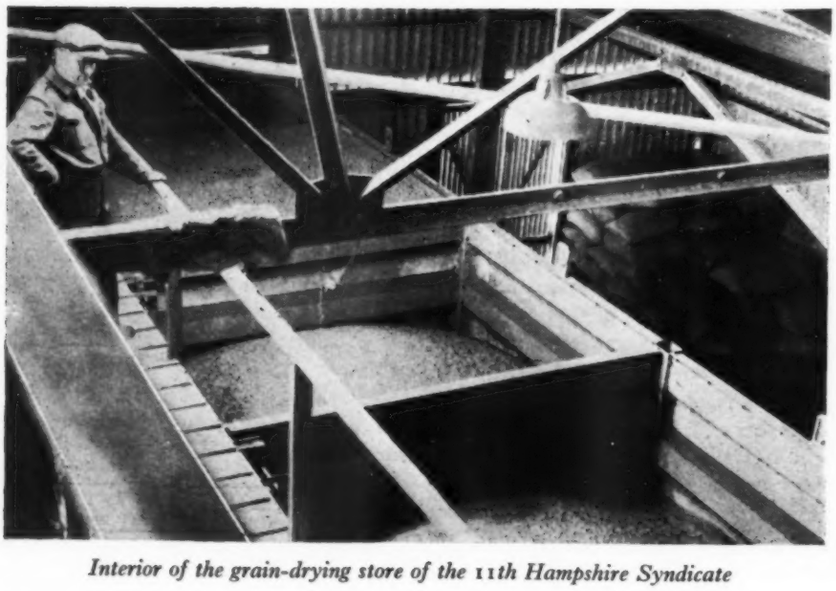
Another example deals with an item of fixed equipment. A large syndicate of 14 farmers erected a large drying and storage plant. They made their initial payment of 20% as required; the remaining loan from Syndicates Credits Ltd. was to be paid off over five years, with interest charged at 1½% over the ruling bank rate.

The N.F.U. circular upon this venture states:

'Since the plant is to cater for 14 members with varying acreages, a system of operation had to be agreed upon which would be fair to small and large users alike. In consequence, each member has agreed to a quota tonnage upon which capital repayment is based, and which the syndicate undertakes to dry. The total quota amounts to 940 tons, and the initial payment was based upon the figure of £2 per ton of quota.

'To give a practical example of what it costs, let us assume that a member's quota is 50 tons. In July he paid £100 deposit; his next payment is due on 5 April, 1959, which will be £50, plus interest on £400; the next payment will be October 1959, when a further £50 capital repayment is required, plus interest on £350, and so on for the period of repayment. After this period the member will have paid £500 plus interest on the reducing capital loan.

'For an outlay of £500 the member will have had the right to dry 200 tons at a charge of £1 per ton. It is important to note that after five years he will have paid all his capital contribution and so will own a share in the drier; his only outlay thereafter will be the drying charge. After all quotas have been completed, members still have the right to dry additional amounts at prevailing rates'.



Interior of the grain-drying store of the 11th Hampshire Syndicate

System of operation

Usage is again the business of the syndicates themselves. For example, the second Hampshire syndicate agreed that, roughly on the basis of their 20-acre unit system, A, B, and C should have three days' usage of the combine harvester each and D two days. Yearly rotas are made for machines dealing with seasonal operations, but the farms are planned as one large producing area and the machines operated accordingly.

Many syndicates favour the system of each machine being maintained and operated solely by one man. This, it is claimed, creates a 'specialist' interest for the machine operators, and to further this interest it is a common practice to pay bonuses for good work and careful maintenance.

Drain cleaned by syndicate-owned mechanical ditcher

Finally, in regard to usage of machines, it is usually agreed that members desiring usage above their acreage or time quota may do so on payment of a fixed charge to the maintenance fund of the syndicate.

Financial benefits

The astonishing financial benefits of these operations is shown by the records of a number of Hampshire syndicates:

Left: *A land drainer which is shared by a syndicate of six.* Right: *A petrol-driven bale loader owned by a small syndicate of three*

Sprayer

After missing some of the spraying season, 128 acres were sprayed. The charge from outside sources was quoted at £692. The syndicate charge, including depreciation, was £372. Saving was £320 to four members.

Combine Harvester

One syndicate showed these results:

Work done – 207 acres of cereals, combine-harvested. The charge from outside sources was quoted at 70*s.* per acre = £724 10*s.* Machinery syndicate costs were £382 6*s.* 1*d.* and the saving was £342.

Another syndicate harvested 287 acres. Charge from outside sources was quoted at 70*s.* per acre = £1,004 10*s.* The syndicate's was £405 4*s.* 8*d.*, and thus the saving was £599.

Other advantages

Apart from these direct financial advantages, others quoted by the credit company are the release of capital to members for other farm developments; the eventual full ownership of first-class tools or, alternatively, due to the servicing agreements, good trade-in or second-hand value; the possibility of increased pay to specialist labour, high standard of work and minimum loss of time through breakdowns. For example, two syndicate combines harvested 514 acres with a time loss, through mechanical fault, of only two hours.

Growth of the movement

The list of machines bought includes combine harvesters, sprayers, ditching machines, beet harvesters, down-the-row thinners, rotary hoes, manure spreaders, sack hoists, hydraulic loaders, hedge trimmers, silage harvesters, balers, tractors, ploughs, cultivators, low-loading trailers, rotovators, side-delivery rakes, drills.

A syndicate of six farmers bought a huge land-draining machine. Another bought the first mobile seed-cleaning plant ever to be built in Britain. The grain-drying syndicate mentioned has now increased storage capacity by a further loan of £2,700 and membership is now up to 18. A further grain-drying plant has recently been erected by another syndicate of 18 members.

Sixteen counties have now formed credit companies. There are now 23 syndicates in Hampshire, the county of origin, and 65 in operation in Britain.

Photos: First two: James Smith; last three: Tom Viney

Automation in Agriculture

(*Continued from page* 92)

production, two such machines are reported to be in the design stage since the International Agricultural Aviation Conference held in September last. Precise details of their propulsion and control systems have not been circulated, but it has been suggested that one of them could become standard equipment on farms of moderate size, in which case it would fit into the fuller automation of crop production.

Automatic irrigation and drying

A number of farm installations not mentioned in the foregoing survey would have to be included in the comprehensive control of agricultural production – for example, irrigation and crop-drying systems. At present the general picture here, briefly, is one of mechanisation, plus limited automatic regulation.

Summary

To sum up, some of the elements of an automated agriculture are already in existence, but as yet this concept is new and the amount of development still needed to make it a reality is very considerable.

Nevertheless, there are prospects that automation will eliminate monotonous and fatiguing work in agriculture as elsewhere, bringing reduction in labour costs, and increase in the speed and accuracy with which many tasks can be carried out.

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Machines for Crop Production Under Irrigation—I

Prepared by Officers of the Land and Water Use Branch of the

Agriculture Division, Food and Agriculture Organisation, Rome

Production practices and equipment, under either total or supplemental irrigation, differ in practically every respect from those used where only natural rainfall is available. The overall economy of production also differs greatly.

Photo: Massey-Ferguson Ltd.

This rear-mounted grader-blader can be attached or removed from the 3-point linkage in five minutes

THE supply of irrigation water is often costly, but irrigation greatly increases land values. The total capital investment per unit area of land is also greater than a resultant increase in the fixed costs of production. In order to meet these and to justify the larger capital investment additional time and money spent on the actual mechanics of crop production is generally justified and necessary. High-yielding, high-value crops and varieties should be grown, fertility levels must be maintained to meet the demands of higher production and the soil must be treated to give the correct conditions for effective water utilisation and maximum plant growth. This often requires special machines with particular attention to correct timing and method of use.

Agricultural development programmes in many countries include irrigation projects to bring large tracts of arid land into production. There is a widespread interest in the mechanisation of agriculture on these new schemes and equally in existing irrigated areas. The purpose of this article is to indicate the types of machines and detail their method of use in irrigated areas, where partial or complete mechanisation has been practised for a considerable time.

Machines employed in irrigation farming may fall into four main categories: (1) machines for water control and drainage; (2) tillage machinery; (3) equipment for weed control; (4) seeding and planting machines.

WATER CONTROL AND DRAINAGE

Large irrigation* projects often involve a considerable amount of earth moving using heavy machinery. The selection and operation of this equipment is a specialised study and will not be dealt with here, but a great deal of work, both in the original development and the maintenance of individual farm irrigation systems, can be done with equipment within the power range of the normal farm tractor. Types of work which can be economically done with equipment within this power range include light land levelling, farm ditching and the construction of water spreading and control structure.

SMOOTHING AND LEVELLING

Irrespective of the method of surface irrigation employed, some land levelling and smoothing is usually necessary to ensure the most efficient use of irrigation water. A wide variety of different types of machines are available for this work. The type best suited to a particular job depends mainly on the amount of earth to be

*The term 'irrigation' here refers only to the application of water by surface means, for the use of sprinklers does not usually necessitate the use of cultural practices and machines differ from those used with natural rainfall.

moved, the condition of the soil and the power available.

Tractor-mounted scrapers

The tractor-mounted bulldozer is probably the best known example of this type of equipment. The term 'bulldozer' usually refers to a horizontal blade mounted in front of a crawler tractor, but similar blades are available in various sizes to suit the power ranges of wheeled tractors. It is a very versatile tool which can often be used as an attachment to a loader. It is considered to be economical to use where hauls do not exceed a maximum distance of approximately 200 ft.

A number of manufacturers produce blades for rear mounting. These are usually of lighter construction, but they are adjustable and can be angled and or tilted for forming bunds and for digging and maintaining ditches.

Trailed scrapers

This implement has a blade similar to that used on a bulldozer, but it is carried on a separate form, the front end of which is attached to the tractor and the rear end is borne on wheels located either at the end of the blade or directly behind it. The depth of cutting or spreading is controlled by regulating the height of the blade in relation to the carrying wheels. This is usually accomplished by a hydraulic cylinder operated from the hydraulic system of the tractor. Designs are available with widths of cut ranging from 6–15 ft. and requiring a tractor from 20–60 h.p.

This implement is economical for haul distances slightly longer than is usual with tractor-mounted blades. Due to the ease and accuracy with which it can be controlled, it is suited to wheeled tractors and it does not place excessive strains on the tractor. It can also usually produce more even levelling than a tractor-mounted blade.

Drag-type carrying scrapers

These are commonly known as roll-over or rotary scrapers. They differ from blade scrapers in that they have a carrying bowl, which carries rather than drags or pushes the earth. Basically, they consist of a steel cylinder split longitudinally and with a cutting blade on one edge. This assembly is fitted to a frame which is towed behind the tractor and can be so controlled that it will excavate, carry, dump and spread. Models with a bowl capacity of from $\frac{1}{2}$–3 cu. yd are available, which can be operated by wheel tractors of from 25–30 h.p. They are inexpensive, can be quickly and easily attached to the tractor and do not require hydraulic control. They can be used to advantage on small fields and for light levelling work with haul distances somewhat greater than those for blade scrapers.

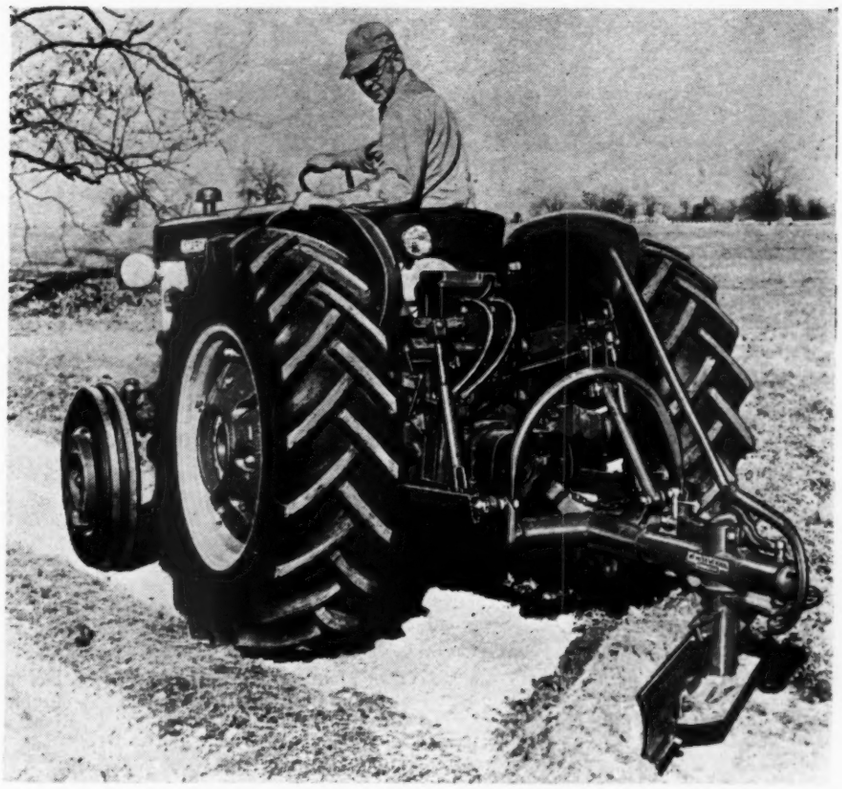


Photo: International Harvester Co.

This heavy-duty rear-mounted blade is designed for high-speed one-man earthmoving. Applications include building and maintaining terraces, ditching, scraping, filling and snow removal

Wheel-type carrying scrapers

Large carrier scrapers with capacities of from 6–30 cu. yd. are used in commercial earth - moving. Now smaller models of from 1–6 cu. yd. capacity for operation with a farm tractor are available. They are capable of digging their own load, hauling it at high speeds and dumping or spreading it at controlled depths. The depth of cut and spread is controlled hydraulically.

These small units are economical for hauling distances of up to 1,000 ft., but the cost may be somewhat higher than would be justified on an individual farm. It is, however, an ideal piece of equipment for a farm contractor, who can use it with the same tractor he uses for other contract work. Thus he can broaden his activities and keep his tractor in use for more hours per year.

Long-span blade leveller

These implements are more correctly described as land smoothers, as they are intended for use on fairly level fields, or on those that have been made so through the previous use of drag or carrier scrapers. Some are called land planes. They consist of an adjustable blade equipped with side skirts, which is attached at, or near, the centre of a long frame supported at either end by wheels or skids. In some cases the front end of the frame may be carried on the tractor drawbar.

The effective levelling length is the distance between the ground support points at the front and rear ends of the frame; thus the longer the frame, the more accurate the levelling. Machines are available with frames from 20 ft. up to 80 ft. in length.

The blade acts as a plane, scraping off high spots and pushing the earth removed until a low spot is encountered, where it is deposited. Blade height can be adjusted in relation to the frame either by mechanical or by

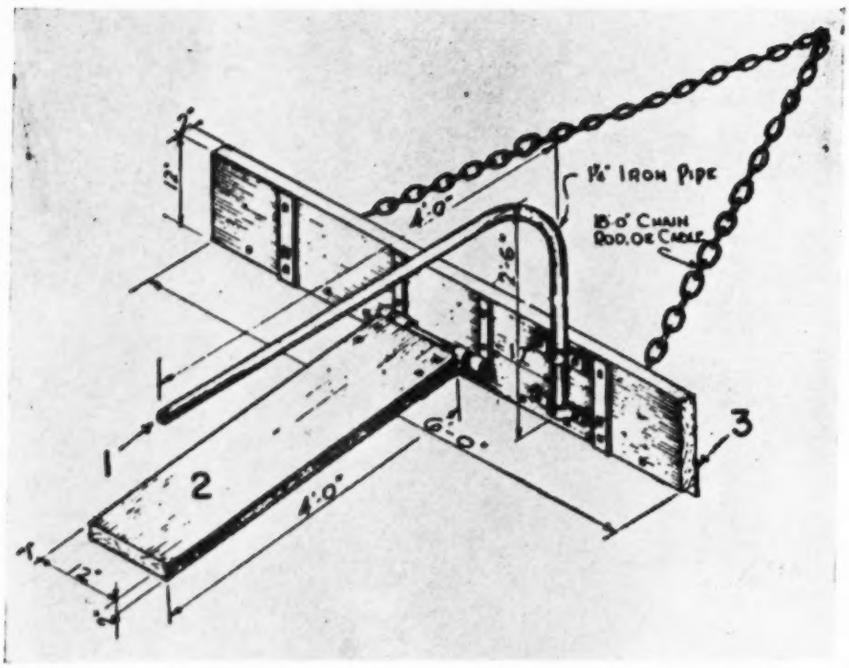


Fig. 1. Buck scraper: 1. Control level. 2. Foot board. 3. Cutting blade

hydraulic controls. When starting a field the operator should so set the blade that it never completely unloads. After this initial setting it is neither necessary, nor desirable, to raise or lower it during operation, but in rough fields it may be found necessary to adjust the blade occasionally to take shallower cuts on extremely high spots in a preliminary run.

Some of these machines have wheels attached to the ends of the blade through a lever linkage. These do not support the frame during operation, but by means of the linkage attachment; when they go over a high spot the blade is slightly lowered, and when entering a low spot they raise the blade to allow for greater depth of spread. This makes it possible for a machine with a short frame to do a better job.

These long-span levellers are ideal for land finishing and smoothing. They are, however, expensive and other than for large projects are usually operated either on contract or hire.

Home-made devices

A number of useful devices for levelling and smoothing can be constructed by local carpenters and blacksmiths.

The *buck scraper* (Fig. 1) is a useful implement for either wet or dry conditions. Depending on soil and moisture conditions, it can be pulled by animals or by light tractor. The operator rides on the footboard and the position he takes – either forward or back – and the angle at which he holds the cutting blade with the control lever

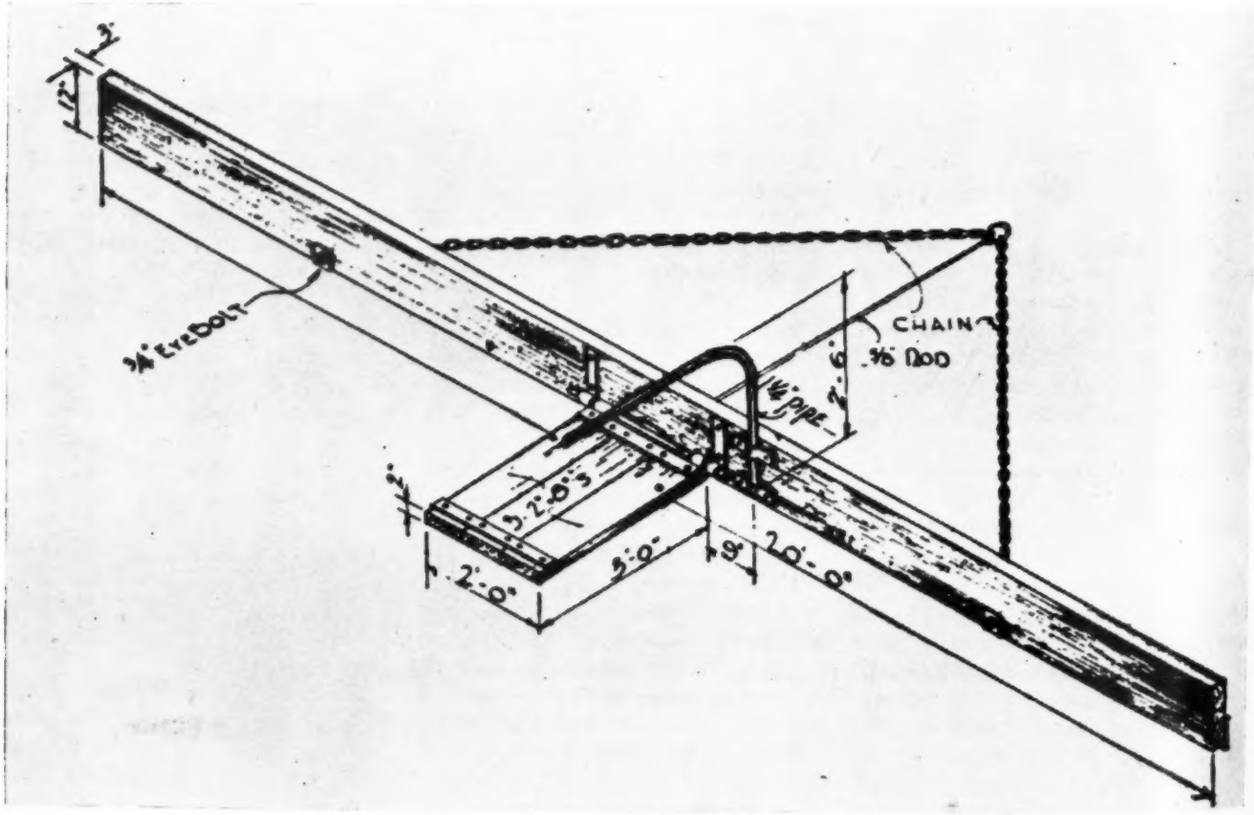


Fig. 2. Cutting float

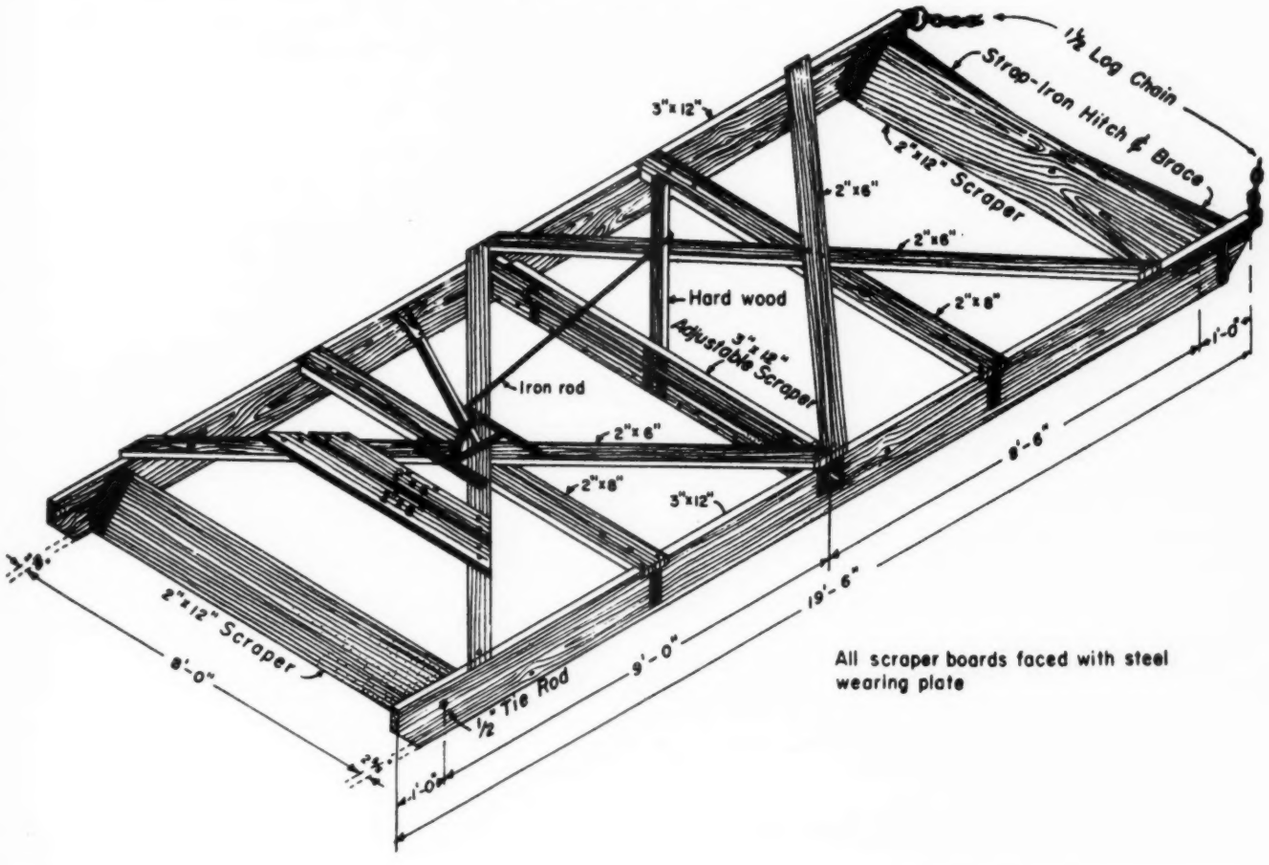
determine the extent of the cutting or spreading action of the blade.

The *cutting float* (Fig. 2) is operated in the same manner, but is for lighter work under dry conditions. It will usually need to be tractor-drawn.

The *smoother* or *float* (Fig. 3) is a useful implement for smoothing out minor irregularities when finishing levelling work. It is normally used each season on all irrigated fields to smooth out the irregularities resulting from previous tillage operations. As with other smoothing devices, the longer the frame the more effective will be the work – it should not be less than 18 ft. in length. It should also have at least one adjustable cross member to allow for more effective use under variable soil conditions. Where required, weights may be added or a man may ride it during operation.

(*To be continued*)

Fig. 3. Smoother or float



Anti-Corrosion in 1960

Plans are being made to make London's Olympia the focus of the anti-corrosion drive in 1960. Participation by the largest and most representative companies in the Anti-Corrosion Industry will make the Corrosion Exhibition of 1960 the biggest, the most interesting and the most comprehensive display of its kind.

Already two-thirds of the space in the vast Empire Hall of Olympia has been reserved – and the exhibition does not open until 29 November.

Paints, plastics, rubbers, plating, resistant metals and alloys, cathodic protection materials, glass-lined plant, rust inhibitors, temporary protectives and protective tapes are among the products which will be on show – many being introduced for the first time. Among well-known companies which have reserved stands are *British Oxygen*, *Shell Chemicals*, *I.C.I.*, *Albright and Wilson*, *Dunlop*, *Yorkshire Imperial Metals*, *Geigy*, *Enamelled Metal Products*, *Ciba*, *Hercules Powder Co.* and the *Plus Gas Co.*

Corrosion science will be represented by the *Department of Scientific and Industrial Research*, who will feature the work of the Corrosion Group at Teddington. Their stand at the 1959 Corrosion Exhibition attracted much attention.

The Corrosion Exhibition will open at 11 a.m. on Tuesday, 29 November, in the Empire Hall, Olympia and will remain open for the next three days – until Friday, 2 December. Enquiries for few stand reservations still available should be made without delay of the Organiser, Leonard Hill House, Eden Street, London, N.W.1 (Euston 5911).

Coming Events

Mechanical Handling. – The Mechanical Handling Exhibition will be held at Earls Court, London, from 3–13 May. Details from the Organiser, Dorset House, Stamford Street, London, S.E.1.

Forestry. – The Forestry Commission is to hold an Exhibition and demonstration of forest machinery on the Yorkshire Agricultural Society's Show Grounds at Harrogate on 4 and 5 May. Details may be obtained from the Machinery Research Officer, Forestry Commission, 25 Savile Row, London, W.1.

Fertilisers. – The seventh General Assembly of the C.I.E.C. (International Centre of Fertilisers) will be held from 16–18 May in Lisbon, Portugal. Information may be obtained from the General Secretary, Beethovenstrasse 24, Zurich, Switzerland.

Grasslands. – The National Grassland Demonstration will be held this year on 8 and 9 June near Basingstoke, Hampshire. It will include field demonstrations of systems of silage making, using various types of forage harvester; hay making, including artificial drying; and fertiliser application. There will also be an advisory section and an exhibition of static machinery. Further particulars may be obtained from the Secretary, National Grassland Demonstration, 170 Piccadilly, London, W.1.

The 8th International Grassland Congress will be held at Reading, England, from 11–21 July, 1960. Enquiries and requests for application forms should be addressed to the Secretary, 8th International Grassland Congress, Reading, Berkshire.

Rural Extension. – The 8th International Meeting on Methods and Programme Planning in Agricultural and Home Economics Extension is to be held at Wageningen from 5–29 July, 1960. Further information from the Director, International Agricultural Centre, 1, Generaal Foulkesweg, Wageningen, Netherlands.

Analytical Chemistry. – A Symposium on 'Analytical Chemistry in the Service of Agriculture', organised by the Midlands Section of the Society for Analytical Chemistry, will be held at Nottingham University on 14 and 15 July, 1960. The programme will include papers on the following subjects: Determination of pesticide residues; determination of metals in soils and plants; analytical aspects of dairy farming; determination of systemic insecticides; analysis of herbicides; the protection of the consumer against harmful effects of pesticide residues; determination of additives in feeding stuffs.

Organisers of meetings, conferences and agricultural exhibitions are invited to supply information for this regular feature. This should be received by the Editor at least three months prior to the event.

Registration forms may be obtained from Mr. C. A. Johnson, B.SC., B.PHARM., F.P.S., A.R.I.C., Standards Dept., Boots Pure Drug Co. Ltd., Station Street, Nottingham, England.

Agricultural Co-operation. – The British Council, in association with the Plunkett Foundation and the Federation of Agricultural Co-operatives of Great Britain and Ireland, is organising a course in agricultural co-operation at Cropthorne, Worcestershire, from 14–27 August. The Director of Studies will be Mr. P. G. Gorst, Education Secretary of the Federation. The introductory lectures will cover the legal basis, organisational structure and business activities of British agricultural co-operation. There will also be lectures on special aspects of agricultural co-operative business management, such as office organisation, finance, technical management, work study and membership relations. Members will also go on study tours over a wide area of the West Midlands and in Wales. Applications should be made to the Director, British Council, 65 Davies Street, London, W.1.

Rubber Research. – An International Conference on Natural Rubber Research, sponsored by the Rubber Research Institute of Malaya, with the support of the Government of the Federation of Malaya and the Rubber Producers' Council, will take place in Kuala Lumpur from 26 September–1 October, 1960. The conference will be held in two sections running concurrently – one for research on natural rubber production, the other for research on the preparation and use of natural rubber and latex. Further information from the Rubber Research Institute of Malaya, P.O. Box 150, Kuala Lumpur.

Corrosion. – The 1960 Exhibition will take place at Olympia, London, from Tuesday, 29 November, to Friday, 2 December. Bookings are now being accepted and full information is available from the Organiser, *Corrosion Technology*, Leonard Hill House, Eden Street, London, N.W.1.

Agricultural Exhibitions

Persian Gulf. – Agricultural Show and Trade Fair will take place from 31 March–7 April, 1960. Information may be obtained from Department of Public Relations and Broadcasting, Manama, Bahrain, Persian Gulf.

Germany. – An Agricultural Exhibition is to be held at Saarbrucken from 23 April–21 October. Further information from Ausstellungstechnische Leitung und Organisation Stadtverwaltung, Saarbrucken.

N. Ireland. – The 93rd Ulster Agricultural Show is to take place from 25–28 May. Further information may be obtained from the Royal Ulster Agricultural Society, King's Hall, Balmoral, Belfast.

England. – The Bath and West Show will be held from 1–4 June. Information from the Bath and West and Southern Counties Agricultural Society, 3 Pierrepoint Street, Bath, Somerset.

This year's Royal Show will be held at Cambridge from 5–8 July. Details may be obtained from the Secretary, Royal Agricultural Society of England, 35 Belgrave Square, London, S.W.1.

The Great Yorkshire Agricultural Show takes place in Harrogate from 12–14 July. Information from the Yorkshire Agricultural Society, Cliftonfield, Shipton Road, York.

N. Rhodesia. – An Agricultural Show will be held at Lusaka from 30 July–1 August. Further details from the Northern Rhodesian Agricultural Society, P.O. Box 333, Lusaka.

Mechanised Farming in Ceylon

G. R. W. DIAS,* A.M.I.AGR.E.

The author discusses the possibilities of various types of agricultural machinery and the limiting factors to progress under Ceylon conditions.

Tractors, given to Ceylon under the Colombo Plan, working in rice fields under wet conditions

THE first tractors to work in Ceylon were received in 1920 and were then mainly used on coconut plantations. It was not until 1942 that the mechanisation of the primary tillage operations in rice cultivation was attempted when some tractors were imported to step up food production, and these were used mainly on the State farms. Their servicing and maintenance was the responsibility of the Mechanical Branch of the Irrigation Department until 1945, when the Division of Agricultural Engineering of the Department of Agriculture was established.

This Division brought the benefits of mechanised cultivation to the peasant farmer by establishing six tractor units on an experimental basis at suitable locations in the country and undertaking work on contract. The economic advantages arising from the use of tractors were thus demonstrated and as a result the demand for tractor cultivation increased so rapidly that it was not possible to cope with the work with the machines, then available.

The Government thereupon established more tractor units with the aid of some 200 tractors received from the Australian Government under the Colombo Plan. The use of tractors was further encouraged by Government making loans to co-operative societies for their purchase. A number of private parties have also purchased tractors, so that, in all, there are in Ceylon today over 2,500 agricultural tractors.

Tractor cultivation is most popular in those areas where there is a shortage of cattle and labour. When tractors are used in rice cultivation the main benefits to the farmer are an increased yield per acre, a saving of irrigation water as the land can normally be ploughed dry, and a saving of time, so allowing them to give more attention to the cultivation of their 'highland†' crops.

Tractor with a disk plough working in a rice field under dry conditions

Highland crops

Crops like cotton, maize, sorghum, chillies, tobacco, kurakkan, gingelly, cowpea etc. come under ' highland '

* Division of Agricultural Engineering, Department of Agriculture, Peradeniya, Ceylon.

† Highland, *i.e.* dry-land crops as opposed to irrigated crops.

cultivation and are mostly raised as rain-fed crops. Rice may sometimes be grown under rain-fed conditions, *i.e.* ' dry ' rice.

In all cases the land is prepared for seeding or planting before the onset of the monsoonal showers. Where these crops are grown in the Dry Zone as rain-fed crops the primary tillage operations are carried out in September after an inter-monsoonal shower of rain. In the case of cotton and maize it is essential to get the land ploughed in time for the crops to be sown prior to the Maha rains. If this is not done, it is likely that a cropping season will be lost, as the heavy monsoonal rains would make the soil conditions unfavourable for preparatory tractor cultivation.

The disk plough has proved to be more suitable than the mouldboard plough in Ceylon, as even under dry conditions the land can often be ploughed with a disk plough. An important consideration in dry ploughing is to see that fine soil particles are not carried away by wind erosion, as a strong wind is prevalent from May to September in the Dry Zone. To overcome this, it is advisable not to use a disk harrow or similar implements on ploughed land during these months.

It is mostly on the State farms that mechanised cultivation of ' highland ' crops is practised. Seed drilling machinery is not commonly used by private farmers, but on State farms they have been employed during the past 10 years. At the Dry Zone Research Station at Maha Illuppalama it has been found satisfactory in ' dry ' rice cultivation to use a broad sweep on the rice stubble and sow a crop of sunn-hemp seed and about a month later to use the disk tiller prior to seeding the rice. Automatic transplanting machines have been used successfully for transplanting chillies and tobacco, and a potato planter has also been successfully used at one of the State potato farms.

At Gal-Oya – the vast colonisation project on the east coast – an extent of about 200 acres were transplanted with chillies as a trial in rows, 3 ft. apart, with a spacing of about 1½ ft. within the row, and with two seedlings per ' hill '. The transplanting machines used at present, however, do not work on soils that are too sticky or too wet. Row-crop cultivation of crops like maize, cotton, chillies, tobacco etc., could be successfully carried out with integrally-mounted spring-tine cultivators. Manure spreaders, maize shellers, ridgers, mowers, have been tried with encouraging results. Combine harvesters, threshing and winnowing machines are being tried for ' highland ' crops, but further trials are necessary before precise recommendations can be made.

Irrigated rice

The total area at present under rice is a little over a million acres, of which about a quarter can be regarded as offering suitable conditions for the mechanisation of the essential cultural operations.

The mouldboard plough, disk plough, disk tiller, the paddy harrow or a tine tiller is usually used for the preliminary tillage. Again, as in ' highland ' farming, the disk plough works better than the mouldboard plough in most paddy soils. The disk tiller works well in soils that are sufficiently moist and it is cheaper to use than either the mouldboard plough or the disk plough. On sandy soils, free from weeds, the tine tiller, used twice, produces a very satisfactory seedbed.

Where the soils are dry and are too hard for ploughing a light irrigation will make it possible. As an inversion of the soil is not necessary, if puddling is to be done, a rotavator or a tandem disk harrow can be used satisfactorily for primary tillage. A puddler, also known as paddy harrow, attached to a tractor, fitted with extension wheels and used twice, has also done a satisfactory preparatory tillage job in the paddy fields. This implement appears to be popular with rice cultivators in some parts of the country.

Trials with seeding and inter-cultivating equipment are still in progress. Seeding to a spacing of 1 ft. apart is recommended where inter-cultivating equipment is available. At Maha Illuppalama this spacing proved satisfactory when inter-cultivation was done with a rotary weeder. Where such inter-cultivation was not done and this spacing was used the weeds were able to compete successfully with the crop and so reduced the yields.

Seeding in rows, 6 in. apart, with subsequent irrigation, has shown that weeds are controlled to some extent. Broadcasting the seed and covering it with a light disk harrowing has been tried with some success in a few colonisation schemes. Many colonists favour this method, as the action of the disk harrow in covering the seed destroys the small weeds, which would otherwise compete with the rice crop.

Harvesting and threshing

Combines for harvesting, threshing and winnowing the rice have been tried on a limited scale, but many difficulties have been encountered. The small size of the individual fields, unfavourable conditions in the field at the time of harvesting in most areas, the unsatisfactory stand of the crop when the plants lodge and the easy fracturing of the grain of most of the rice varieties planted in Ceylon are the main obstacles to the use of combine harvesters.

Even with the pick-up, the combine does not take in all the lodged rice plants under the conditions found in Ceylon. However, in the absence of suitable threshing and winnowing machinery, combines have been tried out with some success for the stationary threshing and winnowing of rice and a few machines are being used satisfactorily in some parts of the country.

In the case of rice the introduction or breeding of varieties of rice which do not easily lodge and the grain of which does not break too readily, is essential for the successful use of combine harvesters in Ceylon. The Department of Agriculture is now multiplying the seed of varieties suitable for mechanical harvesting.

Threshing by running the tractor on sheaves of paddy is fairly common in areas where cattle are scarce for threshing, but with the increasing availability of threshing machines this crude method is likely to disappear.

In certain parts of the country, where the wind is weak, a hand-operated machine, made locally with a fan and bicycle parts, is used for winnowing the rice. It takes about 10 man-hours to winnow 40 bushels of paddy with this simple device.

Suitability of implements

Trailed implements operating in small rice fields, have proved very cumbersome and expensive. Tractors with mounted implements, where the tractor and the implement work as one integrated unit, are, however, popular. Various makes and types of agricultural tractors are now in use, but it is not yet possible to say which particular

Photo: FAO

Tractor being used for threshing and winnowing rice. After threshing, a fan was attached to the p.t.-o. and the chaff was blown from the grains. A wire mesh screen serves as a safety guard

make or type is the most suitable for a particular locality or job.

It has been found necessary to alter some imported machines to suit local conditions. There is also a need to study the possibilities of other machines used for seed drilling and inter-cultivation and to consider the introduction or local manufacture of suitable harvesting, threshing and winnowing machinery.

Although the bullock cart is still in common use for transporting rice from the threshing floor to the grain stores, the tractor-drawn trailer and the lorry are being increasingly used for long-distance transport.

Hindrances and difficulties

Much of the land, especially in the Wet Zone, is unsuitable for mechanical cultivation, due to topographical conditions, excessive fragmentation or divided ownership. It may also be unwise to introduce agricultural machinery where there is a surplus of labour and cattle, unless factory industries can absorb the labour so displaced. Even if mechanisation were possible in such areas, a situation might arise when small farmers, who have their work done by contractors, may be idle for want of alternative employment ; the cattle population, too, may decline, as the tendency will be for the farmers to sell their cattle for slaughter when the machines displace them.

It has been observed that the introduction of such mechanised tillage operations into areas opened up from jungle and developed by human power has resulted in damage to machines and implements due to the presence of side roots of tree stumps, left in the ground. This stresses the importance of using machinery for clearing jungle land intended for agriculture, so that a thorough clearance can be made before introducing mechanised agriculture.

In some cases heavy repair bills have resulted from the damage caused by machinery being used on badly cleared land. Bad management of machinery has been another major cause of unnecessary expenditure. These losses have resulted from the absence of proper supervision and the poor quality of the operators used to man the machines.

To overcome the severe dearth of men properly trained in machine operation and maintenance the Department of Agriculture is training all the students at its farm schools in tractor operation and maintenance and, as a result, about 600 students will be passing out every year adequately trained for mechanised farming operations.

Difficulty of small units

Ceylon has the unfortunate distinction of being the country with the lowest percentage of cultivated land under food crops in Asia, for no less than 70% of Ceylon's cultivated acreage is under plantation crops. Once population started increasing the peasants had insufficient land to extend the area of their cultivation.

Also the fragmentation of land, aided by the laws of inheritance, has brought about the existence of smallholdings which are absurdly small and quite uneconomic units. The average size of a smallholding in Ceylon is only about $\frac{3}{4}$ acre, the smallest units being found in the Kandyan districts. In Jaffna district, too, there is a high percentage of holdings below an acre in extent; on the other hand, in the Batticaloa district of the Eastern Province holdings of 10 acres, or more, are quite common.

In some cases, a single piece of land is owned by more than one owner, and this system forces a co-owner to take his turn to cultivate the whole field. Production standards are never very high, for none of the co-owners is really interested in improving the shared land.

New colonisation schemes

There is a population of over eight millions in Ceylon and the total consumption of rice is about 950,000 tons per annum. The rate of multiplication of the population is about 250,000 per annum, which is said to be more than double the world rate of increase. Even if the yield of the present acreage under rice can be doubled by improved methods of cultivation, there will still not be enough rice produced to feed 250,000 mouths every year at the present rate of increase in population.

Therefore, it would appear to be necessary to bring more land under food crops to compensate for the low yields of rice obtained at present and to keep pace with the increase in population. In addition to introducing machinery into areas where there is a shortage of cattle and labour, machinery should be used in new land development work and cultivation operations mechanised as far as is possible. Holdings in new colonisation schemes should be made and kept large enough for machinery to be used efficiently and economically.

As most of the peasant farmers in Ceylon are too poor to purchase machinery, the Government or the multi-purpose co-operative societies organised recently may have to own the machinery and undertake work on a contract basis, as is already being done in some parts of the country.

Manuring of Crops in the Far East

H. L. RICHARDSON, D.I.C., M.SC., PH.D.*

In Part 1 the author considered the cereal crops. Here he goes on to deal with the requirements of the various oil-yielding, fibre and fruit crops of the region.

2—Oil-Yielding Crops

Coconuts. The coconut palm is grown in many countries of the Far East, often in a semi-wild condition, not far from the coasts. There are also some fair-sized plantations, particularly in Ceylon, Indonesia and the Philippines, but recent estimates of area are not available. In any case, such figures are of doubtful value, owing to the lack of uniformity in planting rates. As a rough approximation, there are about 10 million acres in the Far East.

Experimental work has shown that the fertiliser response varies greatly with the soil on which the palms are grown: nitrogen does not usually have much effect, phosphate is needed only on very deficient soils, but potash is generally important; magnesium deficiency also occurs. Thus coconuts may in future take up useful amounts of potassium and magnesium fertilisers, although it is only on plantations that manuring is likely to be done, and the total quantities required will not be large.

Oil Palms. These palms are being grown in plantations to a limited extent in Indonesia, Malaya and other Far Eastern countries. Experiments have shown that young palms need heavy applications of complete fertiliser; mature or bearing palms have similar fertiliser requirements to those mentioned above for coconuts, potash being generally required, with nitrogen or phosphate on some soils, but not on others. Unless the area of oil palms increases greatly, their total consumption of fertilisers will remain small.

Sesame. Gingelly seed is an important crop in India and it is widely grown elsewhere in the Far East to provide cooking oil, the total area being about 10 million acres. Little is known about its nutrient requirements, but there is some evidence that, as with linseed, sesame responds poorly to fertilisers. The area of the crop is large enough to suggest that further experimental work to determine whether there are conditions under which fertilisers can be used effectively would be worth doing.

Photo: Malaya House Inf. Dept.

Coconuts growing on alluvial clay in Malaya show little response to fertiliser applications

Oil palm estate, showing bunches of fruit in foreground

Soya Beans. Although these are used to some extent for human food – particularly in the form of ' bean curd ' – and as a green manure, they are mainly grown in order to obtain cooking oil from the crushed seeds. Manchuria is the headquarters of this industry, but the soya bean extends widely through other parts of the Far East and the total area is large – about 35 million acres. The crop has been little fertilised in the past. In Japan

* Imperial Chemical Industries Ltd.

A plantation of Abaca, or Manila hemp, ready for harvesting

it receives some phosphate, and on many soils, especially where the rainfall is high, it should respond to both phosphate and potash.

Groundnuts, grown both for oil and for direct human consumption, are likewise extensively grown in the Far East and cover more than 20 million acres, India having the largest area under this crop. Little work has so far been done on their manuring, but, as with soya beans, both phosphate and potash are likely to be effective.

Rapeseed. This crop, once much grown in Western Europe in order to provide colza oil, is an important one in China, India and other Far Eastern countries. The oil is used in the Far East for cooking, as well as for illumination, and, although it is being replaced by paraffin or electricity for lighting, the crop is still widely grown, its area approaching 25 million acres.

Fertiliser experiments carried out on rapeseed in China showed that the crop is more responsive to phosphate than are the cereals; in this it resembles other cruciferous crops, such as turnips, and the effect is likely to be a general one. Thus it is to be expected that rapeseed will offer a useful future outlet for both nitrogenous and phosphatic fertilisers, although the crop does not receive much manuring at present.

3—Fibre Crops

A considerable variety of bast fibre plants is grown in Asia, including jute (*Corchorus*), linen flax, hemp (*Cannabis* and *Crotalaria*), ramie (*Boehmeria*), Deccan hemp, roselle fibre, mesta or kenaf (*Hibiscus*) and others. Most of these are grown only on relatively small areas for local consumption; jute is the only one that finds an important place in world markets.

Jute is mainly grown in the high-rainfall regions of India and East Pakistan, the total area approaching four million acres. Experiments on the manuring of the crop, which is usually grown under wet soil conditions on alluvial soils, have shown good results from heavy applications of nitrogen, along with phosphate and potash, and, although it is doubtful whether much fertiliser has been used on the crop in the past, usage is likely to increase.

Linseed and Flax. In Asia it is difficult to separate the two uses of this crop, which is mainly grown in India and to a less extent in China and Japan. The total area, about four million acres, is not very large, and linseed is not, in general, a crop that responds well to fertilisers, so any future outlet is likely to be a small one.

Manila hemp. Abaca (*Musa*), grown in the Philippines, is a ' hard ' fibre of importance, little is known about its manuring and the area planted is not enough to offer a large fertiliser outlet.

Cotton. We are so accustomed to thinking of America as the main cotton-producing continent that it may come as a surprise to find that Asia has a larger area of cotton than any other continent, and most of this – nearly 40 million acres – is grown in the Far East. Average yields, however, are low, so that the Asian production of cotton lint does not compare with that of America. In the Far East, India, China and Pakistan are the chief cotton-growing countries; the crop is largely home consumed.

Harvesting flax by hand, with a field of Irish potatoes beyond. The flax received little fertiliser, but the potatoes are heavily manured

Cotton does not always respond so strikingly to fertilisers as does rice, sugar-cane or tea, and the manuring of cotton in Asia has been rather slow in getting under way. Recently, however, along with the improvement of varieties and cultural methods, more attention has been given to fertilising cotton, and because of the large area of the crop it offers a considerable outlet in the future.

Cotton generally gives a useful response to nitrogen, especially if the crop is irrigated; its responses to phosphate and potash depend very much on the soil where it is grown. If, as is usual, the cotton is grown in rather low-rainfall areas with unleached soils, there may be little response to the mineral nutrients; if, however, the soil is a sandy one, then potash is likely to be needed.

Nitrogen response with cotton: on the left, PK without N; on the right, NPK

4—Fruits

Pome Fruits. Apples and pears are extensively grown in the northern parts of China, and in Japan and Korea. Full information is not available about the extent of these crops, but taken together their area is probably about half that of citrus in the Far East. When, as often happens, the trees are grown on eroded hillsides without manuring, they may show the symptoms of both major and minor element deficiencies; and where fertilisers are used heavy rates of application of all three major nutrients are recommended. Thus an appreciable tonnage of fertilisers is already consumed by apples and pears, and more could certainly be used with advantage; yet, because of the small area occupied by these crops, the future consumption cannot reach large figures.

Citrus. These, including oranges, mandarins, grapefruit, pomeloes, lemons and limes, are found throughout the Far East. Although only incomplete figures for their area are available, the total is likely to approach one million acres. In Western countries citrus fruits respond well to heavy applications of fertiliser, especially nitrogen, but little work on their manuring has been done in Asia, except in Japan. They offer a potential market that might be developed much further in the future.

Photo: C.O.I. Crown Copyright reserved

A pineapple plantation on deep peat in Malaya

Tropical Fruits. Few statistics are available for the areas occupied by these fruits, which include bananas, pineapples, mangoes, papayas, jak or breadfruit, and many less widely known kinds. Except for bananas and pineapples, they are mainly grown in gardens around the cultivators' houses and are manured with household or animal wastes. It seems unlikely that most of them will take much chemical fertiliser in the foreseeable future.

Bananas and pineapples are heavily manured and respond well to fertilisers, especially to nitrogen, in the West Indies, Hawaii and other countries where they are grown on a plantation scale. They already receive fairly heavy fertiliser treatment in Formosa and increasing amounts of chemical fertiliser are likely to be used on bananas and pineapples in other parts of the Far East where they are grown as commercial crops.

(*To be continued*)

Push-Button Farming

A Swedish firm has developed a farm tractor which can be remote-operated from a compact radio-control transmitter. Multi-channel transmission makes it possible to perform a number of operations (hydraulic lift etc.) by remote control.

The tractor has a built-in recorded programming system so that it will also operate unattended without a transmitter. Alternatively, the radio link can be replaced by a pilot cable laid along the route to be followed by the tractor. Impulses generated by the cable are picked up by the electronic 'brain' of the tractor and so control its various functions.

The transmission is all-electrical, but hydraulic, vacuum and other systems are equally applicable.

The European Productivity Agency of OEEC reports that the system, manufactured by A/B Bolinder Munktell, is being used mainly for field testing and trials under exacting conditions without drivers.

Supercharged Tractor

If bench tests of a supercharger designed to boost internal combustion engines working at high altitudes are successful, the East African Industrial Research Organisation intends to fit one to a farm tractor for operation in the Kenya highlands at altitudes of between 5,000 and 7,000 ft.

Agricultural Tractors in Italy

A Serious Problem for the European Common Market

C. B. L. WISS, PH.D.(ECON.)

The pressure of population on the land in Italy is an obstacle to the growth of heavy industries and to the increased productivity of agriculture.

ACCORDING to the latest *Handbook on Italian Agriculture*, the figures in Table 1 give the tractor position over the last five years.

It shows that in Italy approximately 20,000 additional tractors go into service each year for agricultural purposes. By comparison, France and Germany, already possessing over half a million agricultural tractors each, take in between 70,000 and 80,000 units each year.

Agriculture may stagnate

In the case of Italy, with a present total of a little over 200,000 tractors, it is recognised that there is need for at least half a million more, yet the number of new tractors entering service is not only decreasing, but the number going to the scrap heap is increasing. In the next few years the number of tractors to be withdrawn from service will be even higher, as many have been in use for 20 years or more. Unless the intake of new tractors increases, agriculture will stagnate and so damage the economy of the nation as a whole.

The figures indicate that the net increase in tractors in 1954 was 24%, with thereafter a yearly decrease to the low figure of 9% in 1958. Perhaps the main reason for this decline is the enormous number of smallholdings cultivated by the owner, his family and beasts of burden. The cost of a tractor is too high for such small farmers and it is practically impossible to group them together in order to create tractor syndicates.

The farmers are mostly dependent for their requirements of seed, insecticide, implements etc., on the Government-owned 'Agrarian Consortium', and few can say they are not continuously in debt to this organisation.

Bitter Rice – Modern Version

A land girl at the wheel of a SAME '240' tractor puddling an irrigated rice field preparatory to planting

There are five major tractor manufacturers – Fiat, Landini, Lombardini, Orsi and Same – and also a large number of smaller firms in Italy. There are also imports from the U.K., Germany and Czechoslovakia. The Perkins engine is being manufactured under licence by the Landini Co. and is used almost exclusively in their units.

The National Research Council has done good work in promoting demonstration trials in a number of communes to show the smallholder the many advantages of using tractors in agriculture. The national industries have also offered a 25% discount on all tractors to be used for similar trials all over the country, but very little progress has been made.

Large and small scale operations

Agriculture in Italy falls into two groups. On the one hand, the medium to large enterprises are equipped with machines and implements capable of almost every agricultural operation and these are comparable with the most progressive farms anywhere in Europe. On the other hand, there are the innumerable smallholdings where man and beast still carry out the many fatiguing tasks which in other countries are done with machines.

The Minister of Agriculture has

Table 1

	Tractors		*Increase*	
	Entered into service	*Withdrawn from service*	*Net*	*%*
1954	25,139	851	24,288	24
1955	24,425	1,956	22,469	15
1956	23,526	2,616	20,910	12
1957	22,920	3,080	19,740	10
1958	22,080	2,996	19,084	9

Left: *Landini R.50 tractor doing a heavy job of deep ploughing. This machine has automatic depth control.* Right: *Fiat 241R tractor fitted with a tractor-borne multiple jet sprayer working among the olive groves of Italy*

stated that 54.6% of the tractors are operating on holdings of up to 62 acres; 17.6% on those between 62 and 112 acres; 11.8% on those between 112 and 250 acres, and finally 16% on those with more than 250 acres.

This is misleading, and Table 2 gives the true position. It will be seen that, while it is correct that the greatest number of tractors are to be found on smallholdings, only one smallholder in 40 actually owns a tractor; in actual fact, holdings of up to 25 acres have practically no tractors. This means that over 100,000 tractors are in service on holdings of between about 38 and 62 acres, the degree of mechanisation increasing with the size of the holding.

In the case of smallholdings, the peasants not only lack the means, but also any knowledge of modern operating techniques, and they also say that they have not enough land for a tractor to be economical. A small tractor, they admit, would be a gift from heaven, but its cost must not exceed £200, whereas the cheapest they can buy costs not less than £500. To this must be added the running and maintenance costs.

The problem is not an easy one, but an early solution must be found, for it is not only the future of a multitude of small farmers that is at stake, but also the well-being of the entire country. Yet during the past five years over a million television sets worth, say, £100 million have been purchased – roughly the same sum has been spent on the purchase of tractors in 20 years.

Table 2

Category of holding	*Number of Holdings*	*Number of Tractors*	*Holdings per tractor*
Up to 62 acres	4,100,000	113,042	40
Between 62 and 112 acres ..	56,000	36,372	1.5
Between 112 and 250 acres ..	25,000	24,446	1
Over 250 acres	20,000	33,140	0.7

There is danger ahead, since the import duties on goods from fellow Common Market countries are to be progressively reduced over the next few years. This will mean that those countries producing tractors in quantity will be able to offer tractors at lower prices than Italian manufacturers. Furthermore, farm produce grown with modern aids in other countries will be able to enter freely and Italian farmers will only be able to compete if they are heavily subsidised.

Technical News

Articles in the March issues of some of the other journals of the Leonard Hill Technical Group include the following:

Manufacturing Chemist.–'Worm Infestation: the Chemist's Approach to an Important National Problem' by A. Mackie, D.SC., F.R.I.C., F.R.S.E.

Public Works & Muckshifter.–'Hydraulics in Earthmoving Equipment' by I. McNeil, M.A., A.M.I. MECH.E.; 'Fertiliser Production is Aided by a Wriggling Ditch' by G. W. Smith.

Specimen copies of the above journals are available on application to Leonard Hill House, Eden Street, London, N.W.1.

The second part of the article 'Paints in the Tropics' by P. Whiteley, B.Sc., A.R.I.C., will be published in the April issue.

NOTE FOR CONTRIBUTORS AND AUTHORS

The editor welcomes authoritative articles and news items on agricultural machinery and agricultural methods, agricultural crops and new developments.

The purpose of WORLD CROPS is to keep horticulturists, farmers, plantation managers and specialists in related fields of research informed of the latest developments in agriculture.

Articles should therefore be written in the kind of language which the layman can understand, particularly since an expert in one field is a layman in another.

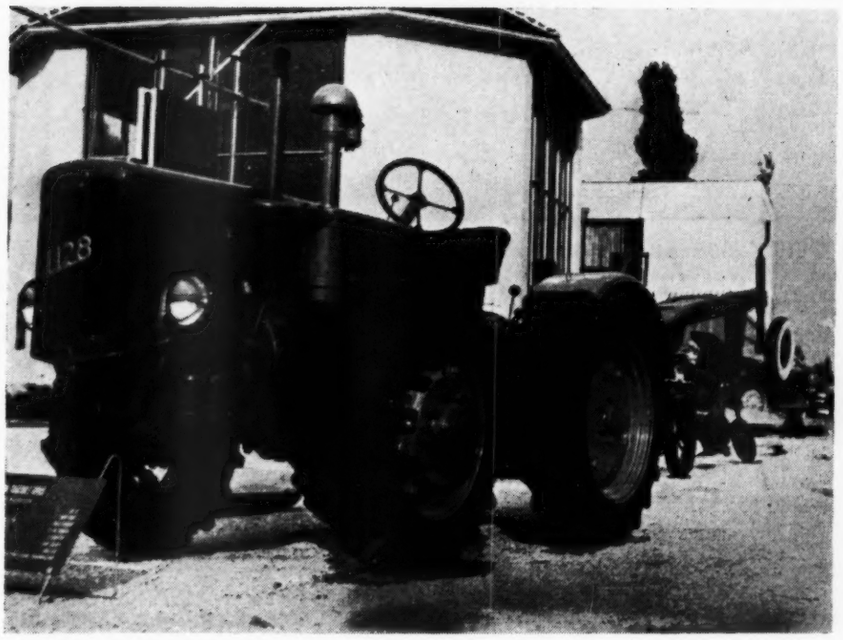
A short synopsis should preferably be included to assist the editor and the manuscript itself should be typed in double spacing with plenty of margin and on one side of paper only.

It should bear the name and address of the author and be accompanied by sharp photographs or line drawings with suitable captions.

Budapest Exhibition, 1959

DIP.-ING. L. HORVATH

Nearly two million visitors from all the countries of Europe visited last year's Budapest Fair, where they saw the latest products of agricultural engineering. Subsequently these machines were seen at work on the State farm at Perbal.



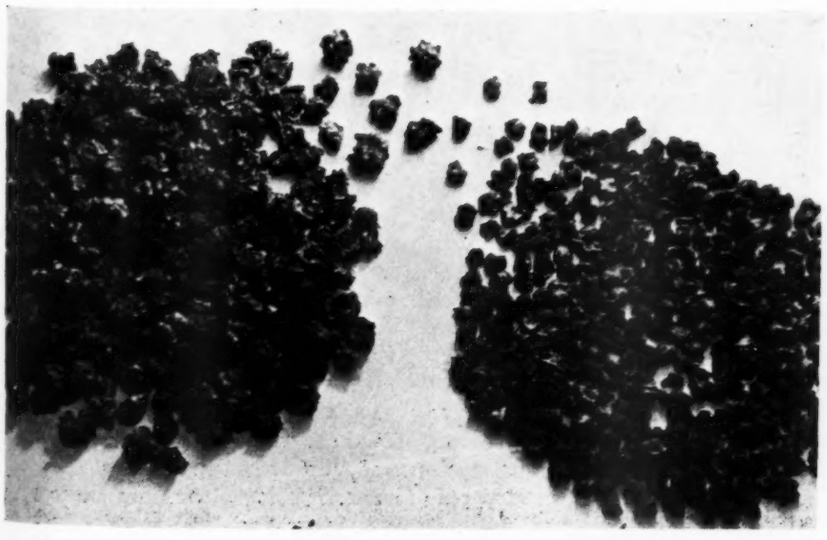
The U.E.28 4-wheel-drive tractor, manufactured at the Hungarian State Works, ensures uniform weight distribution

THE 63rd Hungarian Agricultural Exhibition brought a great display of new machines and prototypes; there were, of course, many established types, but several countries, especially Hungary, showed the results of several years' work in development and research. Most of these machines illustrated the prevailing trend towards specialisation, with machines for vineyard cultivation, for maize, for sugar-beet etc.

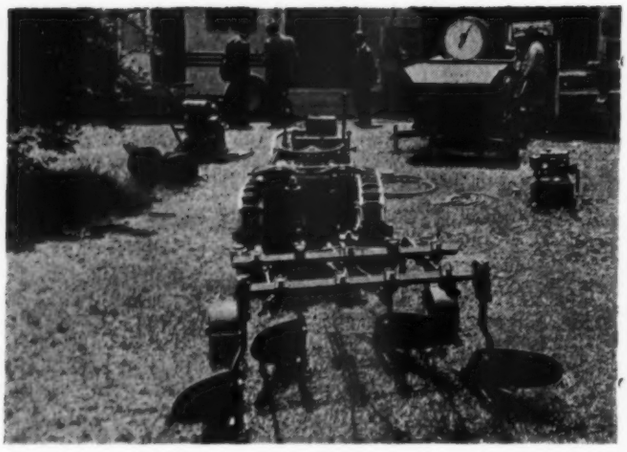
Tractors were present in large numbers: the U.S.S.R. showed the 'Beloruss' tractor with its many implements; for East Germany the 'Maulwurf' formed the centre-piece of the pavilion. A large number of vineyard tractors, now in great demand in Hungary, were shown: the Massey-Ferguson 35 tractor was presented in its narrow 46-in. version and Ransomes had their 'MG' vineyard tractor on display. Simca, of France, showed the 'Som 45' with a 1,300-mm. track and also a high-clearance tractor for maize. The need for vineyard tractors was demonstrated by the caterpillar tractor with a walking driver which had been made up from scrap materials by the Producers' Co-operative at Gyöngyös.

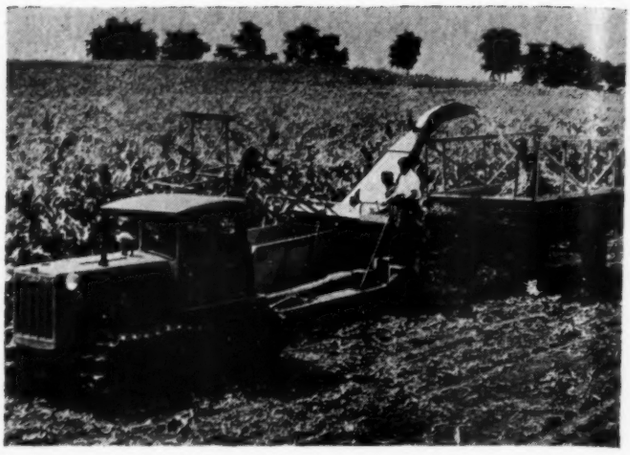
The Hungarian State Works exhibited their new 4-wheel-drive tractor, Type UE-28, which has been specially designed for the sandy soils of the plains, where 2-wheel-drive tractors sink in and crawler tracks wear out too rapidly. This machine is suitable also for wet paddy soils. Its 28-h.p. engine is a 4-stroke, 2-cylinder, water-cooled diesel, giving 1,650 r.p.m. This tractor has six forward and two reverse gears and it weighs about 2½ tons.

The same works has produced a new crawler tractor, Type DL-60, designed for deep ploughing and for operation with heavy implements; it has an engine of the same type as the UE-28, but with four cylinders and giving a drawbar pull of 4.5 tons; it weighs 5.4 tons.



Sugar-beet seeds polished and, with covering, unpolished





Left: *A Ransomes M.G. vineyard tractor seen at the Budapest Fair.* Right: *The U.S.1,2 silage harvester, made at the Hungarian Mechanical Handling Works, seen in action at the Perbál State Farm*

Sugar-beet machinery

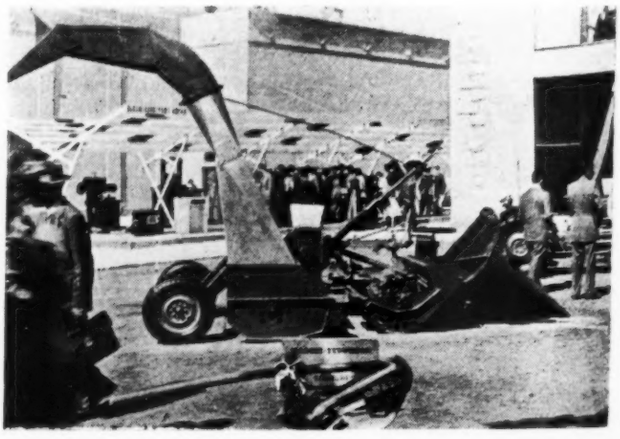
Sugar-beet cultivation is very important in Hungary and the Research Institute at Sopronhorpacs is occupied mostly with breeding new varieties suited to Hungarian conditions.

They have developed a husking machine to produce better seed. Sugar-beet seed has a tough porous covering, which is difficult to remove and will delay germination if it is not removed. The advantage of decortication is that the seed can then absorb moisture better and so will germinate better in dry soils. These polished seeds are more easily graded and are delivered more evenly from the seed drill. The seed also loses in the process 50% in volume and 25% in weight.

There are other types of polishing machines, but these, being mechanically operated, damage the seeds and are also more complicated. At Sopronhorpacs they have developed a process whereby the seeds are polished more gently and yet quite as efficiently. The seeds are agitated under pressure in a conical container and they fret the covering of each other away. This machine will polish 300–400 lb. of seed per hour. The new process is especially important for the new thick-coated polyploid varieties, since it is necessary to sow many more seeds than with the ordinary varieties, and so polished seeds are essential for efficient seed drill operation.

Maize-harvesting machinery

Maize-harvesting machinery was the main feature this year. With the rapid increase of maize growing the need for suitable harvesters has now become more urgent, especially as the types already developed are not too satisfactory. The Institute for the Design of Agricultural Machines has produced a new single-row harvester based on the experience gained with the heavy 2-row machines, Type KB-1.



Massey Ferguson '740' silage harvester at the Budapest Exhibition

The new machine is mounted on a 28-h.p. tractor, with a supporting land-wheel. It weighs only 0.75 tons and is of simple construction with the cutting mechanism on the right and the hopper for the ears on the left. It is, therefore, well balanced and stable, so that the machine is suitable for use on slopes. The cutting device is now more reliable: the ears are broken down by rolls of new design and delivered into the hopper; the stalks are chopped and blown out on to the ground or into a trailer. There is no husking mechanism, the ears being delivered only half-husked into the hopper, but there is a reduced working loss. The machine is sturdy and simple and it uses only 6–10 h.p., so that a 25-h.p. tractor is quite adequate. Because of the lack of such machines, there are still countries where the cobs are broken down by hand and the stalks are left a long time in the field and so lose most of their nutritive value.

The Institute for Agricultural Implements of the Technical University at Budapest has designed a binder-harvester for long-stalk plants, such as maize, hemp, reeds etc. This machine has a powerful cutting mechanism, but otherwise is very similar to other binders.

Massey-Ferguson Ltd. exhibited many machines, including the M.F. 740 and 760 forage harvesters, which can be used for maize by changing the chopping mechanism, the chopped material being blown into an accompanying trailer.

The Mechanical Handling Works of

Hungary exhibited a new silage harvester, Type US-1,2, which is a smaller variety of the larger Type SzJS-1,8, but is of new design without a blower; instead the chopper blades are designed to blow the fodder into the trailer. The machine, which has a cutting width of 2 ft., can be drawn behind a 25/30-h.p. tractor. The height of the cutting mechanism and of the reel is controlled hydraulically by the driver, so as to follow the undulations of the ground. The stalks are laid by the reel flat on a table and feeding cylinders convey them to the chopper drum, which free-wheels if any hard, solid obstruction is introduced. The capacity of the machine is about 15–18 tons of green fodder per hour.

Chopped silo fodder is coarse and there is an opinion that crushed pulp is better for cattle and for silage making. This difference of opinion has not yet been resolved, though the agricultural works at Törökszentmiklos has produced a suitable pulp crusher, Type SzZ, which operates like a hammer-mill. It has a drum of 1,000 mm. wide with 48 hammers and it produces 60 tons of crushed pulp per hour. It requires 15–20 h.p. and weighs 0.6 tons.

Horticultural implements

By the complex mechanisation of large-scale gardening a wholly new field was opened by the Research Institute of South Hungary at Szeged. Many mechanised tools are available for home gardening, but market gardening – a very important activity in Hungary – has not till now been mechanised. This has been a serious disability in onion growing, onions being an important export crop which is produced on an enormous scale in South Hungary.

All the operations are very labour-absorbing, especially when they are grown in close-planted rows. Ordinary cultivating implements are not suitable and cultivation has mostly to be done by hand. Scarcity of labour has, however, made the large-scale production of seed onions nearly impossible and so effective mechanisation is an urgent matter, as many growers are solely dependent on this crop for their livelihood.

Universal Machine

The Research Institute of South Hungary at Szeged has developed a universal machine with which all the necessary operations – from drilling to harvesting – can be done with the one machine simply by changing the implements.

The machine consists of a frame which is attached to the hydraulic mechanism and carried by the tractor. The first operation – the levelling of the seedbed – is done by means of a smoothing blade set across the machine ; the beds are formed between the tracks of the tractor wheels and with various implements the rows are produced, lined across or the furrows drawn, if necessary. Afterwards seed-drilling units can be attached to the frame and the seed planted.

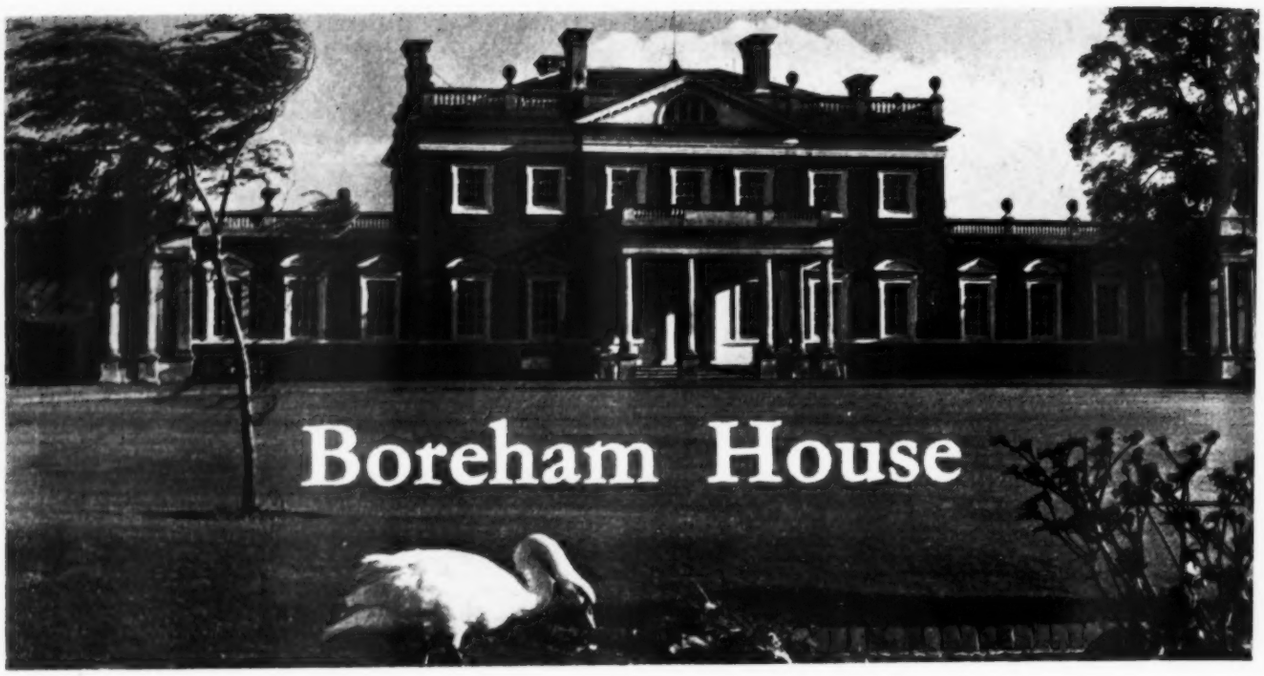
The plants can also be cultivated by the same machine and at last the ripe onions are lifted by small disk harvester and collected by hand. The machine is already mass produced by the Machine Works Makó. It is also suitable for the large-scale cultivation of other vegetables.

Mechanical feeding and milking

In the livestock section, the Research Institute Nyiregyháza showed a mechanised cowshed in which fodder was introduced by conveyor belts. The feeding could be regulated by altering the speed of the conveyor and the meal directed to the stalls by individual shutters; a mechanical milking machine on wheels is brought to each cow in turn; and in the middle of the shed there was an under-floor ditch with a conveyor so that the dung can be swept in through openings in the floor, and delivered to an elevator and into a trailer outside the building.

The exposition was an outstanding success, nearly two million visitors attending from all countries of Europe; a practical show was held for the experts on the State farm at Perbal, where all the new machines were shown at work.

Left: *New type K.B.1 maize harvester designed by the Hungarian Institute for the Design of Agricultural Machines.*
Right: *Binder-harvester for maize stalks, designed at the University of Budapest*



Training and Instruction in Mechanised Farming

BOREHAM HOUSE, in Essex, built in 1728, was formerly one of the stately homes of Britain. Among those who have lived in it were Warren Hastings, first Governor-General of India, and his friend, Sir Elijah Impey, the first Chief Justice of Bengal.

Today it is the Mechanised Farming Centre of the Ford Motor Co. Ltd., presided over by Mr. R. E. I. Turner, the manager. Completely redecorated and refurnished, this lovely mansion provides residential accommodation for some 30 students. Besides the usual social amenities, there are lecture rooms and workshops with instructional aids, such as cut-away models of engines and tractor parts, and a comprehensive range of Fordson tractors and implements for practice and demonstration on the 76 acres of land adjoining the Centre. There is also a comfortable cinema for instruction and relaxation.

The purpose of this training centre is to provide courses of instruction and product knowledge for salesmen and demonstrators, dealers and distributors, and service managers and field representatives, both in Britain and in overseas countries. Training courses are also arranged for personnel from Government departments and demonstrations of Fordson tractors and farm implements are given to visitors from all over the world. In addition, new machines and techniques are tested here and their value assessed.

The normal duration of the regular course is one week, but this can be extended to allow for further studies. About 1,500 students take this course annually and, in addition, nearly a thousand visitors arrive from all parts of the world. In this way a knowledge of mechanised farming is disseminated to the widest possible audience.

In July 1959 some 50 farm machinery lecturers and instructors from British Farm Institutes and County Councils held a three-day conference at Boreham House, and in October a number of distinguished agronomists and the principals of Agricultural Colleges from 12 European countries witnessed a large-scale demonstration of tractors and implements and inspected the training facilities of the Centre.

Overseas visitors watching a demonstration of Fordson tractors and implements

New Publications

Bananas

By N. W. Simmonds. Pp. 431. Illus. Longmans, Green & Co. Ltd., London. 1959. Price 45*s*.

This latest addition to the series of books on tropical agriculture is welcome. The book is planned to appeal to three groups of readers: the research worker, the agricultural officer and the planter. The account of banana-breeding work undertaken at the Imperial College of Tropical Agriculture, West Indies, since 1922, when the College was founded, is an interesting record. Features of the book are an account of cultivars, together with keys which will aid identification, and lists of clones for a number of selected areas. Each chapter has a concise summary which enables the reader to digest the varied aspects of the subject matter.

The basis of classification of cultivars which separates the Australimusa and Eumusa series of cultivated varieties is comprehensive and followed by annotated lists of clones met with in various countries. The Eumusa section is of primary importance and dealt with in some detail. It is shown that of the two species contributing to the edible bananas, *Musa acuminata* and *M. balbisiana*, the former is of major importance.

Various forms of *Musa acuminata*, several being edible varieties, are described as used in crossing with the Gros Michel banana to produce clones, resistant to Panama disease and leaf spot. These diseases and a third, bunchy top, are explained in detail, together with references to recent research work. Bananas are, in general, little affected by pests, but a list of such insects is included and the control of five major insect pests described.

World banana production is estimated at about 20 million tons per annum, of which 15% enters banana trades and the remainder is consumed domestically. The importance of the crop to peasant agriculture in various countries is emphasised. The history, botany and nomenclature receive careful attention. A general account of banana breeding, omitting cytogenetic details, is included. Climate, soils, manuring, plantation production and harvesting are also dealt with. Biochemistry of the fruit and storage and ripening problems are discussed, but technical matters of the distributing trade are omitted. The author acknowledges Fawcett's well-known book, 'The Banana', published in 1913, which readers may remember.

J. N. MILSUM

Technical Books
308 Euston Road
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as retail booksellers will be pleased to supply any books reviewed in this periodical, and will give immediate attention to any requirements you may have for other works

Grass Productivity

By André Voisin. Pp. 352, illus. Crosby Lockwood, London. 1959. 50*s*.

In this book, M. Voisin has combined his knowledge of science and practical farming with a philosophical approach to the techniques of grassland husbandry. At the heart of his philosophy is the concept that if maximum animal production is to be attained from grassland then the grass itself must be allowed to express its full potential and should therefore be utilised at the correct stage of growth to ensure the maximum yields of dry matter compatible with a high nutritive value.

To achieve this, grass must have adequate rest periods after defoliation so that it has the opportunity to replenish its reserves and maintain itself in a vigorous condition. M. Voisin condemns rotational systems of grazing which are based on fixed rest periods. He emphasises that the rest periods must vary with the rapidity at which the grass is growing and this in turn differs with the growing system.

Rest periods will normally be short during the late spring and early summer, as at this time grass is growing rapidly and is at its period of maximum production. During the summer, because the grass is slower in recovering after defoliation, the rest periods must be longer. In winter fresh herbage growth is almost non-existent so that there should never be more than one defoliation.

To achieve this system of graded rest periods, or as the author terms it, 'rational grazing', full use must be made of conservation, and the maximum possible conservation should coincide with the period of maximum grass growth. The whole system depends upon the provision of an adequate number of paddocks so that some may be closed for cutting, and brought into the grazing rotation when longer rest periods are required.

The idea of dividing herds into two or more groups so that the first group may 'cream-off' the best herbage is not new but, like the rest of this book, is presented in a practical manner and shows how scientific knowledge can be incorporated into a sensible farming system. The very fact that, under his own farming conditions, M. Voisin has produced over 6,000 lb. of starch equivalent per acre will speak for itself. The emphasis throughout the book has been on the use of the dairy cow in obtaining maximum production from grass. It must be remembered, of course, that other classes of stock, *e.g.* sheep, may present different problems which, although based upon the same fundamental principles, may require a different grazing system in practice. Probably the major contribution of the book has been the author's emphasis on a dynamic approach to grassland management and the spotlighting of errors which can arise by adopting inflexible systems.

The book itself is very attractively produced, but it is to be hoped that in the next edition most of the small errors, which have presumably crept in during translation, will be corrected.

H. K. BAKER

Royal College of Science

Research Report, 1956–59, of the Royal College of Science, University of London. Pp. 77. Illus. Price not stated.

This is the third of the triennial reports on research work in progress in the seven departments of the Royal

College of Science, London. Brevity in a report is commendable, but it is doubtful whether justice can be done in 77 pages to the extensive and impressive research which has been carried out in this college during the past three years. The inclusion of a list of published articles by members engaged in this research would at least have enabled the reader to amplify this very briefly described work.

Numerous subjects of research have a direct bearing on agriculture: to mention but a few – aspects of the physiology of growth, carbohydrate metabolism, biological fixation of nitrogen, the chemistry of waterlogged and swamp soils, fundamental work on insecticidal action and research on animal parasites and plant nematodes.

D. H. GRIST

Hunger and Food

Edited by Josue de Castro. Special edition of *Science and Mankind*, No. 1. Pp. 123. World Federation of Scientific Workers, 27 Red Lion Square, London, W.C.1. 1958. Price 10*s*.

This symposium of 12 articles considers the problems of hunger and nutritional diseases. The articles fall, naturally, into three groups: food in relation to population, possibilities of increasing food production and the relationship between nutrition and disease.

The general theme appears to be that food production will continue to lag behind population increase, although potential world food resources are capable of supporting a vastly increased population. In this connection the Malthusian theory – population increases faster than production of its means of existence – has been disproved largely as the result of improved methods of farming, but present-day scientists appear to be unable to estimate the rate of future population increase. Alleviation of hunger throughout the world, it is thought, will depend less on the total amount of food available than on a new structure of society that will ensure better distribution.

While the fight against mass hunger has achieved some success, there is now evident a widespread nutritional unbalance – a 'hidden hunger' – found in groups enjoying relatively superior diets, which results in lowered resistance to many diseases and a high mortality index for digestive diseases. Much of this malnutrition is due to dyspepsia, diarrhoea and the way that food is prepared. Whereas in the past attention has been concentrated on providing diets which are balanced in their chemical and biological properties, it is now considered important that nutrition be studied in relation to man's environment, and those interested in nutrition should establish a more reasonable balance between laboratory and clinical work.

In the present confusion of ideas on hunger and nutrition one cannot but be impressed by Erschoff's enquiry stated in *Nutrition Review*. He asks:

> 'What is the ideal diet? Can this question be answered without a clearly formulated philosophy as to what we wish to accomplish with our own life and that of future generations? Is the "ideal" diet one that promotes the most rapid growth, or longest survival, or greatest freedom from diseases, or the greatest capacity to survive unfavourable environmental conditions, or exposure to radiation? Is the "ideal" diet one that best promotes fertility or mental exertion or emotional stability? We have no assurance that these objectives are compatible. On the contrary, there is good evidence that at least some of them are not'.

While this book throws light on some aspects of the tremendous problems concerning food and hunger, it does not and cannot supply the answers. Every article, however, is highly provocative and thus, by casting doubts on accepted precepts and 'pet theories', it is a stimulating book which deserves to be carefully read.

D. H. GRIST

Agricultural Aviation

Quarterly periodical of the European Agricultural Aviation Centre (E.A.A.C.), Ie v.d. Boschstaat 4, The Hague, Netherlands. Price 24*s*. per annum.

E.A.A.C. is an independent, international, non-profit organisation established under the auspices of O.E.E.C. which aims at promoting the use of aircraft and helicopters in agriculture and forestry. *Agricultural Aviation*, the publication of the Centre, is intended to keep those concerned with the use of aircraft informed on new types of aircraft, technical developments and new equipment and also on agricultural chemicals and fertilisers. Its columns are open to research workers who wish to contribute articles on this specialised use of aircraft.

The fourth issue of the journal, recently published, contains articles on agricultural aviation in Turkey and Italy, drift and aphid control in sugar-beet by aerial spraying in Yugoslavia, descriptions of new types of agricultural aircraft and equipment, together with extracts from recent agricultural aviation literature.

Agricultural Aviation claims to be the first and only periodical of a scientific technical character exclusively devoted to this subject. In view of the growing interest in aviation in agriculture and forestry the journal should attract world-wide attention.

D. H. GRIST

Other Publications

Among the many publications received in recent months are:—

Partners in Development, a brochure describing the purpose of the Colonial Development Corporation and its work in the middle months of 1959. Published by the Colonial Development Corporation, 33 Hill Street, London, W.1. Price not stated.

Handbook of Toxicology. Vol. III – Insecticides, containing quantitative, tabular and comparative data derived from valid tests by explicit methods on the subject of insecticide toxicity. Vol. IV – Fungicides, intended, not as a definitive work, but as the preliminary structure for a more exhaustive and better documented report.

Both volumes were prepared under the direction of the Committee on the Handbook of Biological Data, Division of Biology and Agriculture, the National Academy of Sciences, the National Research Council. Published by W. B. Saunders Co., Philadelphia, U.S.A.

National Institute of Agricultural Botany. Thirty-ninth Report and Accounts, 1958. Obtainable from the Secretary, N.I.A.B., Huntingdon Road, Cambridge, England. Price 2*s*.

East African Agriculture and Forestry Research Organisation. Annual Report, 1958. Record of research from January – December 1958. E.A.A.F.R.O., P.O. Box 21, Kikuyu, Kenya. Price 3*s*. 6*d*.

The Ransomes self-propelled combine harvester (left) *is threshing the corn, while the tractor-drawn baler on the right is picking up the straw*

Machinery and Equipment

Harvesting Experiment

The outstandingly good harvesting weather in Scotland last year caused a Scottish farmer to have second thoughts after he had cut his corn crop with a binder. He had every intention of stacking it and later using the straw for winter feed, but with the continued dry hot weather he decided to thrash the corn in the field.

The sheaves were laid in rows 28 ft. apart – that is equal to four 7-ft. swaths with the binder – and the bands were cut with a hedge knife. By laying the sheaves crossways to the line of pick-up the straw came out of the combine in as good a condition as if it had come through a threshing mill and it was not broken in the least.

The *Ransomes* '902' tanker self-propelled combine harvester was then brought into action to pick up and thresh the corn, off-loading the grain through the delivery spout into the accompanying trailer in the usual way. The straw was then immediately baled and stored for feeding purposes.

High-Speed Baling

The photograph on the right shows the new *Bamford-Long* B.L.61 automatic pick-up baler picking up and baling straw previously ejected from a combine harvester. This new p.t.-o. model incorporates many new features and is available with an *Enfield*, an *Armstrong-Siddeley* or a *Lister* diesel engine, according to requirements. Its high capacity of up to 10 tons per hour will appeal to farmers with large acreages, agricultural contractors and machinery syndicates.

For the Small Farmer

The small farms and market gardens of the world vastly outnumber the plantations, estates and large farms; to all small farmers it will be good news that a small crawler tractor – the 'Spitfire' – has recently been announced by the *Wallbridge Mfg. Co. Ltd.*

Power is provided by a 4-stroke, petrol-driven *Villiers* engine with belt and gear reduction of 3:1 on the output shaft, developing $4\frac{1}{2}$ h.p. and giving a shaft speed of 800 r.p.m.

The tractor, being carried on two separately controllable tracks, can turn on its own axis, so saving time and making for ease of operation in confined spaces. The power is transferred to the tracks through two separate gear boxes, each having three forward and one reverse gears. These make it possible for each track to move independently in either direction.

The whole of the body is totally enclosed and made weatherproof. The makers stated that the tractor will be economical to operate, is low in fuel consumption and will require little maintenance. What appealed to us was its clean design, which makes it possible for a sarong-clad operator to drive it with little risk of serious accident.

The new Bamford-Long B.L.61 automatic pick-up baler

While this highly manoeuvrable tractor will primarily appeal to the small farmer, it will be invaluable for operations under restricted conditions, such as along the zigzag paths of tea or rubber estates, in young forest plantations, in close-planted orchards and fruit gardens, and in and around close farm buildings, wherever paths and gateways are narrow and for acute ' U ' turns.

A New Look

With the increasing applications of the internal combustion engine – many of which are operating under all kinds of conditions and in all weathers – there is an urgent need for better protection of sparking plugs from rusting and external surface deterioration.

The Champion Sparking Plug Co. Ltd. are now producing sparking plugs with zinc-plated, silver-colour finish of attractive appearance and more rust-resistant than hitherto.

New Tractor Development

The J. I. Case Co., which has been in existence in America for over a hundred years, and is today one of the world's leading manufacturers of tractors, has formed a £1 million British subsidiary registered as *J. I. Case Co. Ltd.*

Initially British operations will comprise eight basic models for industrial and constructional use with crawler tractors and dozers up to 100 h.p., shovels up to 2 cu. yd., and wheeled loaders from 35 h.p. to 120 h.p., with a capacity up to 2¼ cu. yd.

Spectacular Results

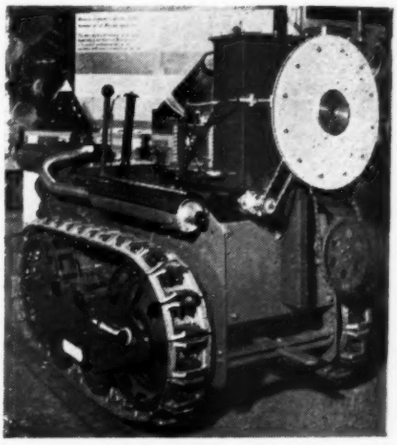
After a long period of drought certain soils may set so hard that ploughing in the ordinary way is an impossibility, particularly where depth is required. A Yorkshire farmer has found a way around the difficulty by using two tractors in tandem, one acting as a ' chain horse ' for the other. Using two *David Brown* wheeled tractors and a *David Brown Albion* deep digger plough, he was able to plough at the rate of about two acres a day to a depth of 12–18 in., with three 56-lb. weights on the plough as ballast.

The ' Spitfire ' tractor can turn in its own length

Two tractors working in tandem to break up a rock-hard soil

The hard-baked, rock-hard soil was broken up into huge boulders which showed signs of extensive cracking within a week of ploughing. His 30 acres of stubble took on the appearance of a boulder-strewn beach, some of the lumps measuring 2½ ft. x 2 ft. x 1 ft. and weighing well over 2 cwt. each.

With winter frost and rain these will break up and produce a deep loam, which, he anticipated, will give excellent conditions for potatoes and sugar-beet this year.



The Micron vineyard sprayer making its debut at Smithfield Show

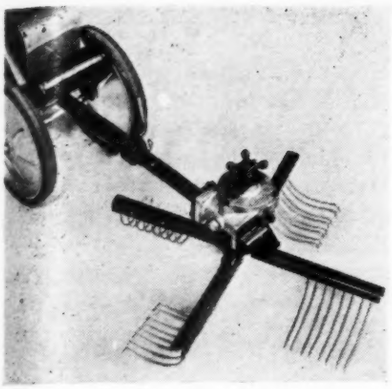
Tractor and Implement

More and more the accent is to provide agricultural implements for attachment to a mobile power unit. More and more are spraying machines being designed for operation through the p.t.-o. of the tractor.

The ' Micron Twin ' first came on the market early in 1958 for spraying top fruit, soft fruit and ground crops. This is a powerful air-blast machine, incorporating rotary atomisers for producing fine spray droplets.

The latest introduction of *Micron Sprayers Ltd.* is the Micron vineyard sprayer, which has been designed for attachment to the *Ransome's* M.G.6 and the *David Brown* 2D and other types of vineyard tractors. The attachment may be made by one man in under five minutes.

This is mainly for the spraying of hedge-grown crops, *e.g.* vineyards, raspberries, blackcurrants, cordon fruit and any crop grown in rows. Obviously it will be equally suitable for crops which may be hedge-planted with narrow lanes between, such as tea, maize, sugar, coffee and sisal.



The new attachment for ' Gardenmaster ' mechanical cultivators is a rotary scarifier, shown here mounted on a ' Gardenmaster 80 '

Rotary Scarifier

A new attachment – a rotary grass scarifier – has recently been introduced by *Landmaster Ltd.* for use on their 'Gardenmaster' mechanical cultivators.

The implement consists of four arms attached at right angles to a centre-piece, each arm having four curved tines with an angled end. The attachment is easily fixed to the basic power unit without the use of special tools and by its rotary scouring action frees the ground of weeds, moss and matted growths.

The attachment is easily reduced to its component parts for cleaning and storage purposes.

Soil Scrapers

The *Servis Equipment Co.*, of U.S.A. has announced that their 66-in. and 72-in. soil scrapers are now available with a 2-point fast hitch feature to fit *International Harvester* tractors.

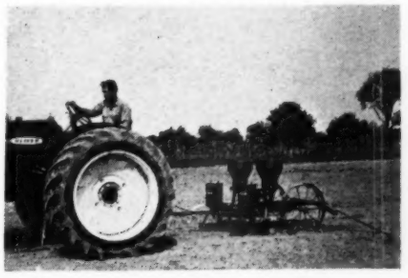
The standard version has a 3-point hitch, the 66-in. model having six scarifier teeth, and the 72-in. model nine. Other features include a different curve in the mouldboard section to ensure a full load of dirt, and a full-length bumper bar on the rear blade to prevent bending under rough service.

Automation in Agriculture

Sir George Dowty, chairman of the *Dowty Group of Companies*, addressing the National Power Farming Conference at Cheltenham, said that as a manufacturer of hydraulic machinery he was proud of the part hydraulics was playing in the development of agricultural machines, for one of the greatest contributors to powered farming has been the widespread use of hydraulic means for the transmission of power.

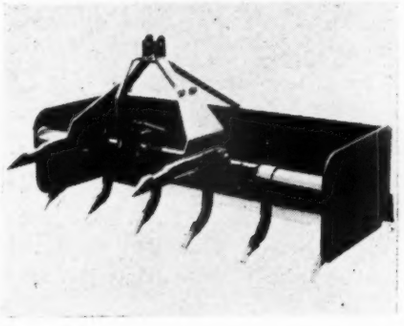
' This simplification of controls ', he said, ' has brought us nearer the day when agricultural machines can operate without men '.

Despite the fact that farmers in Britain are losing agricultural land at the rate of about 25,000 acres a year (according to an A.E.A. spokesman) through new towns, vast aerodromes, enormous factory sites, tremendous new motorways, British farmers armed with modern hydraulically-powered implements are able to work faster, to catch the seasons, to do operations hitherto considered impossible, and so produce more crops from less land.



Above: A model 112, 2-row planter being drawn by an Oliver tractor

Below: The 66-in. Servis soil scraper with the new 2-point fast hitch



More Power

When in 1954 the 3.4-litre diesel engine produced by the British Motor Corporation was fitted into the *Nuffield* ' Universal Four ' tractor, the power rating at the flywheel was stated to be 45 b.h.p. at 2,000 r.p.m. In the intervening four years there have been a number of modifications made to this engine, which have resulted in a considerable increase in power. Consequently, the current production models will produce at the flywheel 53 b.h.p. at the same r.p.m.

Mechanical Planting

The *Oliver Corporation*, of U.S.A., has recently introduced two high-speed 2-row planters for use in market gardens and small farms. The No. 312 model is for attachment to the standard 3-point linkage and its companion, the No. 112 model, is a hook-on unit, which can be drawn behind any type of farm vehicle.

They can be operated at speeds of up to 6 m.p.h., and both are adaptable for row spacings between 30 and 42 in., with a seed-planting rate of nine instead of the more usual six.

One hundred tons of silage was obtained from 3½ acres of maize which had reached a height of over 10 ft.; it has been successfully harvested by a Wilder ' Sila-Masta '

A M.-F. ' 702 ' tractor fitted with the new ' 710 ' rear-mounted digger

Variable seed plate sizes make it suitable for a wide range of crops, *i.e.* for planting small seeds, such as cucumbers, beets, tomatoes and asparagus, or for larger seeds, such as maize, groundnuts, sorghum, peas and beans.

In addition to the twin seed hoppers, there are two 80-lb. fertiliser containers with openings conveniently near the ground for easy filling. The placement of the fertiliser can be varied according to requirements.

Topsoil Consolidation

The ' Flexicoil ' land packer, manufactured by *Goodes Engineering Co. Ltd.*, is a heavy steel spiral which is drawn over an area of cultivated land immediately after it has been cultivated in order to consolidate the topsoil and so check soil loss by wind erosion. The implement can either be drawn independently by animal traction or it can be attached behind another tractor-drawn implement, such as a multiple plough, chain harrow, disk harrow, deep-tine cultivator or seed drill, so that two operations can be carried out in a single run.

The operating principle of this new implement is diagonal surfacing. The coils of the rotating spiral are slightly diagonal to the line of travel and so are able to cut through any lumps, high spots and ridges left by the preceding implement, so leaving a good firm and level seedbed.

Hydraulics in Ditch Cleaning

The new *Massey-Ferguson* ' 710 ' rear-mounted digger has a 185° operating arch, so that the implement can even be operated while the tractor is at right angles to the canal, estate drain or ditch edge, so measurably reducing the time taken in moving progressively along the line of work.

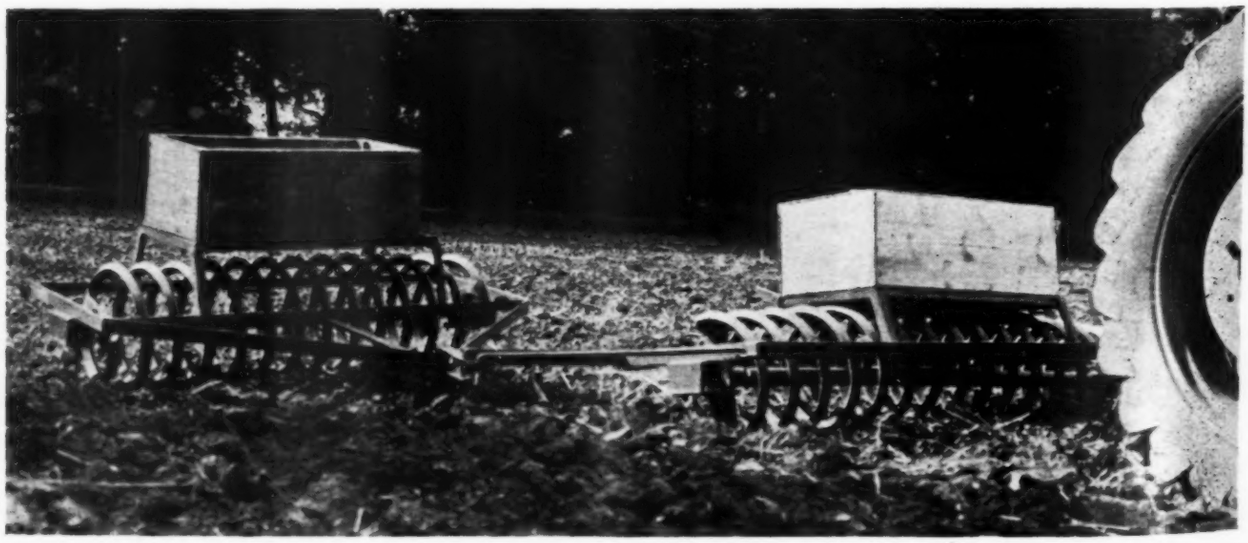
The new implement has a reach of 13 ft. 8 in. and can go down to a depth of 12 ft. With a hydraulic trench bucket fitted there is a dump clearance height of 8 ft. With a ditch clearer fitted, it is capable of a work output of 2 chains or 44 yd. per hour.

Finger-Tip Control

Effortless finger-tip control of Caterpillar DW20 and DW21 tractors is provided by the ' SynchroTouch ' transmission control, recently introduced by the *Caterpillar Tractor Co.*, of U.S.A. It is possible for the driver to change up or down instantly by merely dialling the desired gear, so that a gear change is effected in an effortless fraction of a second.

This gear selector is placed conveniently to the right of the operator at arm level and is mounted on top of the control box. Although it replaces the normal gear lever, a standard clutch foot pedal is retained, but this is only used when the machine is started.

This new transmission control makes it possible for the operator to make quick gear changes in rapidly changing grade and terrain. This precludes any tendency for him to stay in an incorrect gear rather than change gear to suit conditions. The operator is able to maintain high performance because of reduced fatigue and because of the rapid gear changing, operating times being reduced also.



A gang of three ' Flexicoil ' land packers (one out of sight). Each roller carries a weight box which can be loaded with 5 cwt. of material, if required

Agricultural Chemicals and Supplies

Quick Marking

Bold identifying marks on boxes, cartons, bales, drums and crates are necessary for the storage and shipment of agricultural produce and can serve as a useful advertisement if the trade mark of the product is also shown.

The 'Kabey' quick-marking system, already widely used in Britain, gives clear and unmistakable lettering on wood, hessian, cardboard or metals, even on rough surfaces. The type holders are made in light aluminium alloy and may be either curved or straight; a simple spring-lever action picks up the assembled types from the cradle and then grips them firmly. The resilient rubber type is inked on an ink pad in the usual way and the consignment is marked with an easy rocking motion. Type sizes range from $\frac{5}{8}$ in. to 8 in. in height, shipping mark stamps, with or without words, can be supplied and special trade mark stamps can be made to order.

The 'Kabey' marking unit is manufactured in Germany by *K. & W. Beyer OHG* and is distributed in U.K. by *Paul Plura & Co. Ltd.*

Persistent and Safe

'Simazine 50 W' is recommended by the manufacturers, *Fisons Pest Control Ltd.*, as a safe and persistent herbicide for selective weed control in tropical plantation crops – pineapples, sugar-cane, sisal, tea, coffee, maize, rubber and citrus; and also for rice, hybrid sorghums and tapioca, but not for cotton, tobacco, stone fruits, soya bean or groundnuts. It is also recommended for soft fruits and vines.

It is offered in the form of a wettable powder, which is readily dispersible and gives a stable suspension in water. Being virtually insoluble, the spray will persist in the topsoil even under heavy tropical downpours and its low solubility prevents the material creeping on to nearby crops which might be sensitive.

It is not only safe to the operators, but the manufacturers state that there is no crop residue problem, and it is harmless to livestock and game. Applied before the weeds have emerged, it simply kills them as soon as they appear and the crop will then remain weed-free for a full season.

Pre-emergence weed control in maize with simazine. Left: *unsprayed and overwhelmed.* Right: *sprayed and clear*

Non-Malting Barley

There are usually about three million acres under barley in Britain, of which about two-thirds is grown for malting and only about a third is produced as a feeding stuff, whereas the real requirements are the exact opposite.

According to *Mr. Sam Nickerson*, of the Grimsby firm of seed merchants, a new variety, 'Vada' – a feeding barley – could make barley growing in Britain a much more profitable business. Many farmers are over-impressed by the small premium that is paid for malting barley and they overlook the factor of yield . . . but this is only part of the story, because there is more trouble and there are greater losses through shedding when making sure that the barley crop reaches the correct stage of maturity required by the maltsters.

In effect, it costs more to produce a malting barley even where conditions are entirely favourable. Sometimes they are not, even though malting barley continues to be grown in unfavourable conditions merely because of the premium.

'Vada' is a new large-grained variety, which was bred at the Dutch Government plant-breeding station at Wageningen and has now been introduced to Britain. It is claimed that this variety matures seven days before 'Proctor'; it is shorter in the straw and so is more resistant to lodging; it is extremely resistant to mildew; it makes quick growth in the spring and so will give better ground cover in a dry year; it produces uniform heads of uniformly large grains and so is easier to harvest by combine; it has yielded up to 11.4% more than other leading barley varieties. It is, we were told, quite as nutritious and quite as acceptable to cattle.

Reader Service

For further information on any item reviewed in this issue please use the card provided or write to:

Reader Service,
WORLD CROPS,
Leonard Hill House,
Eden Street, London, N.W.1,
England

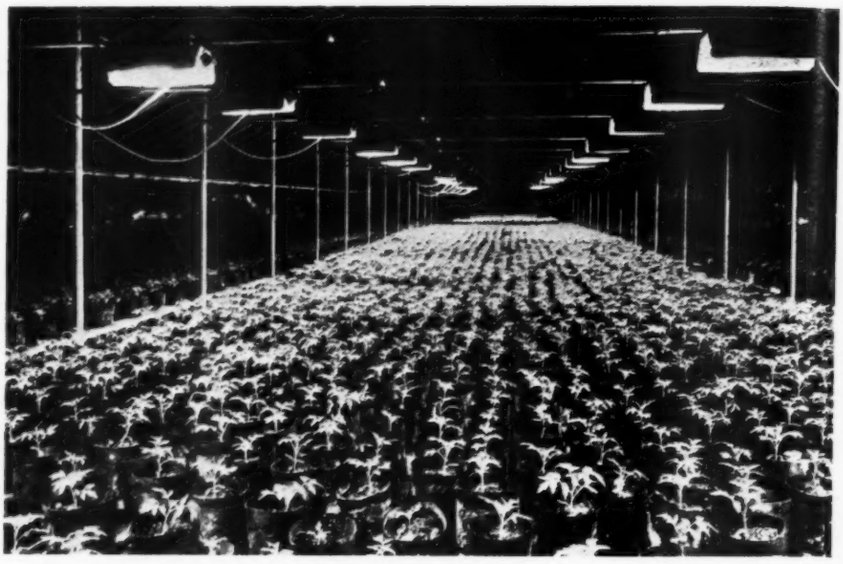
Artificial Daylight

Early-ripening tomatoes have been grown at the Loughview Nurseries, Belfast, Northern Ireland, as a result of irradiation under *Phillips* MB/U mercury lamps.

Encouraged by the success of experiments in the past three seasons, the proprietor of the nurseries equipped a 100-ft. x 30-ft. hothouse with 36 mercury lamps in horticultural fittings. The lamps are controlled by a time switch, so that the plants are irradiated for 18 hours a day.

During December 13,000 plants were irradiated for three weeks. Of these, 7,000 were then selected for planting out, while the remaining 6,000 were irradiated for a further two weeks. A further batch of plants which had not been so treated were then brought into the irradiation house.

All the tomato seeds had been planted on 17 November and transplanted into single pots 10 days later. By 30 December the maximum height achieved by non-irradiated plants was 3½ in., while the average height of those irradiated was 6 in., some having reached 7 in.



Hothouse tomato plants under Philips MB/U mercury lamps

Waterproof Clothing

The ' Duck-dri ' range of waterproof jackets, long coats, leggings, trousers and sou'westers manufactured by *Jeltex Ltd.* are produced to meet the need for a supple, waterproof medium garment which will not easily tear and will give more wear under rough conditions. These garments are produced from a close-woven cotton duck impregnated on the face side with a flexible PVC coating.

Kill That Fly

Control of flies, carrying filth and disease, remains an agricultural and public health problem of considerable magnitude. The use of knock-down space sprays and of residual sprays applied to walls and other surfaces has not been entirely successful in controlling flies and the development of resistance to certain insecticides has been an added problem. A new approach to fly control has been required for some time and the development of dry fly baits now provides a new weapon for controlling these unpleasant and dangerous pests.

The *Standardised Disinfectants Co. Ltd.* is now offering a product called ' So-Dead ' fly bait, which incorporates a highly active insecticide of very low toxicity to animals and man. This bait is scattered, or placed, where flies are seen to congregate. It can be broadcast by hand or it can be placed in saucers or trays beside refuse bins, stables and cattle sheds.

It is coloured blue to avoid it being confused with food or feeding stuffs, and, as it contains insect attractants, it can be expected to kill cockroaches, ants and some other domestic pests attracted by the smell.

New-Type Insecticide for Fruit

Two new folders which describe the use of ' Sevin ' insecticide on fruit are now available from the Chemicals Department of the *Union Carbide International Co.* One folder gives details about the application of the insecticide on apples, pears and peaches, and the other covers its application on grapes.

It is claimed that it will control the major fruit insects, such as the codling moth, *Carpocapsa pomonella*, apple maggot, *Rhagoletis pomonella*, red-banded leaf roller, *Argyrotaenia velutinana*, apple aphids, *Aphis pomi*, plum curculio, *Conotrachelus nenuphar*, fruit tree leaf roller, *Archips argyrospila*, pear psylla, *Psylla pyricola*, grape leaf folder, *Desmia funeralis*, leaf hopper and berry moth.

' Sevin ' insecticide is a carbamate and, being different from other pesticides, will control many insects which have become resistant to the others.

Protection for Cotton

Four additional crop tolerances have been granted by the U.S. Food and Drug Administration for trithion,* an insecticide-miticide developed by *Stauffer Chemical Co.* As a result trithion may now be used on cotton up to harvest time and on cucumber, summer squash and figs up to seven days before harvesting. Tolerances have previously been established for trithion on some 33 crops and it can also be used on several other crops where residues on edible parts are not a problem.

A Correction

We regret that owing to a misunderstanding the article entitled 'Uniform Treatment of Seed' which appeared on page 74 in the February issue, was attributed incorrectly to Mr. C. P. Hampson of *British Schering Ltd.* when it was, in fact, an editorial.

The commentary that 'By this method there is no dust hazard, no poison vapour and no tonic dust hazard' was attributed by mistake to the original method of Prof. Adolf Zade of Sweden, which involved the use of hazardous *volatile* mercury compounds, whereas the Mist-o-matic method of seed treatment does not.

* Trithion is O, O-diethyl-S-p-chlorophenylthiomethyl phosphorodithioate.

World Crop Reports

Copra and Coconut Oil Exports May Improve

INTERNATIONAL REPORTS

Coconuts

World copra and coconut oil exports, which closely reflect the size of the major coconut crops, were again considerably lower. Exports over the last 18 months, as compared with the peak volume reached in 1957, are as follows:

Period	*Exports* 1,000 *m. tons*
1957 First half ..	631
Second half ..	726
1958 First half ..	498
Second half ..	539
1959 First half ..	410

Reduced trade in what was the leading export commodity in the fats and oils group up to 1957 was entirely caused by lower shipments from the *Philippines*. Poor rainfall for 18 months up to mid-1958 lowered coconut yields sharply in 1958 and 1959. At the same time, as desiccated coconut manufacture was maintained, the brunt of the shortfall was felt in copra making.

Copra shipments from January to June 1959 were 234,000 tons, as compared with 385,000 tons and 479,000 tons in 1958 and 1957 respectively. Coconut oil exports were cut back less drastically, the comparable figures being 32,000, 46,000 and 51,000 tons for the first half of the last three years. From June onwards definite signs of recovery appeared and copra shipments reached 54,000 tons in July, 70,000 tons in August and 84,000 tons in September.

Rainfall, according to data for some coconut areas in the Philippines, was lower than average in the last quarter of 1958, and this may still slow down improvement in the last quarter of 1959. Shipments in early 1960 should be related to rainfall somewhat above average in the early months of 1959. By mid-1960, barring such unpredictable events as typhoon damage, 1957 rates of output should be resumed and the upward production trend continued.

Exports from other coconut areas were about 5% higher than in the previous year. Figures for individual countries show no even pattern of increase or decrease, and suggest that rising prices in 1958 and the exceptionally high returns in 1959 were not able to stimulate generally the diversion of larger supplies of coconut to copra making. Due to more favourable weather in 1958, exports of copra and coconut oil from *Ceylon* at 48,000 tons (oil equivalent) more than doubled in the first six months of 1959. *Indonesian* shipments in the same period apparently improved to some extent. The Indonesian economy still suffered from the dislocation of communications with the main exporting islands, and a ban on copra exports was imposed from March to July in order to ensure supplies for domestic use in Java from surplus producing islands.

On the other hand, the combined trade of *Malaya* and *Singapore* showed a net deficit for the first time in 1959 (an import balance of 3,000 tons as oil, compared with an export balance of 11,000 tons in 1958). Copra and coconut oil exports (in terms of oil) declined to 38,000 from 69,000 tons in the comparable 1958 period, while copra imports were 64,000 tons, as compared with 91,000 tons. Despite the attractive export price, Malayan millers were probably reluctant to allow working stocks to fall because of the uncertainty of future supplies from Indonesia. Although copra output in *North Borneo* was maintained in 1959, exports were reduced, as imports from the Philippines and Indonesia for re-export were one-quarter lower.

Shipments from Pacific areas are estimated as slightly lower in the six months period. Combined exports of copra and coconut oil from *New Guinea* and *Papua* declined, although more coconut oil was manufactured for export. The reduction in the trade of the leading producer in this region was not offset by an estimated 5% rise in output in other areas, the great part of which is for export as copra. Various factors contributed to the overall supply increase. In *Fiji* and the *New Hebrides* output was up following low crops in 1958 due to natural hazards. In the *Solomon Islands* Copra Board purchases were 16% above January–June 1958 volume.

Exports from the less important African producing areas were at the same volume as in 1958. *Mozambique*, from which about half the region's exports originate, shipped about the same volume of copra (26,000 tons), but slightly less oil. The growing trade in fresh nuts is limiting copra making in *Zanzibar*, but exports from *Tanganyika* were up to 4,000 tons in the first half-year. Apart from the foregoing, world copra production is minor, but in 1959 36,000 tons were exported from the *Dominican Republic*, probably due to the high level of world prices.

It is expected that world copra production for 1959 as a whole will be equal to the 2.9 million tons produced in 1958. Copra and coconut oil exports in the closing months of the year and early 1960 would therefore probably be at improved rates over those achieved during the first half of 1959. The improvement is expected to continue into 1960 with full recovery in the Philippines rate of output by mid-year, barring unforeseen setbacks. Good crops are forecast in Ceylon and most Pacific areas, where weather conditions have been much better in 1959, particularly as regards the distribution of rainfall over the year.

Source: FAO Review of Coconut Situation, No. 2

Tobacco

World tobacco production at 8,469 million lb. in 1959 was 1% larger than the 1958 world harvest of 8,354 million lb. The 1959 crop, however, was 2% below the 1957 harvest of 8,657 million lb.

Major production increases in 1959 were in the U.S.A., Yugoslavia, Rhodesia-Nyasaland, India and Turkey. Crops in Rhodesia-Nyasaland and Turkey were at record levels in 1959. Larger planted areas in the U.S.A. resulted in a crop of about 1,800 million lb., compared with 1,736 million lb. in 1958. Lesser increases in 1959 production for major producers were registered in Colombia,

France, Italy, the Philippines and Poland. These gains more than offset major decreases in Canada, Mexico, Brazil, Greece and Japan.

Production in North America in 1959 totalled 2,204 million lb., a little below the 2,213 million harvested in 1958. *U.S.* production in 1959 (November estimate) was 1,800 million lb., 4% above 1958, but still the third smallest since 1943. Production of flue-cured, however, at 1,080 million lb. was about the same as in 1958. Most of the gain in the U.S.A. occurred in Burley, cigar leaf and fire-cured. The *Canadian* crop was reduced sharply from 1958 because of extremely unfavourable weather. Crops in *Cuba*, *Mexico* and the *Dominican Republic* were smaller than in 1958. Crops in the remainder of North America did not vary greatly from 1958.

Production in South America in 1959 totalled 475.4 million lb., 4% below the 1958 harvest of 496.5 million. A big drop occurred in *Brazil*, from 308 million in 1958 to 274 million in 1959. This was partially offset by increases in *Chile*, *Colombia* and *Venezuela*.

Production in West Europe in 1959 dropped to 564 million lb. from 583 million in 1958, mainly due to a sizable drop in the *Greek* harvest and lesser declines in *West Germany* and *Spain*. *Italy's* production was about 6 million lb. larger than in 1958 and a record. *France* showed a rise of about 6 million lb. The harvest in Eastern Europe, excluding the U.S.S.R., was 604 million lb., up 8% from 1958, mainly due to increases in *Yugoslavia* and *Poland*.

African tobacco production in 1959, at 410 million lb., was 12% larger than the 367 million in 1958. The major increase was in the Federation of *Rhodesia* and *Nyasaland*, where the 1959 crop, at 231 million lb., was at a record level. Flue-cured accounted for all the Federation's increase in 1959. Production in other African areas did not vary greatly from 1958.

Asian tobacco production totalled 3,728 million lb. in 1959, compared with 3,617 million in 1958. Substantial increases in *Turkey*, where the 1959 crop set a record, and in *India*, more than offset declines in *Japan* and *Indonesia*. There were increases in the *Philippines*, *Thailand*, *Korea* and *Syria*.

The *Australian* 1959 crop of about 14 million lb. (up 2.5 million from 1958) boosted Oceania's total production from 16.2 million lb. in 1958 to 18.9 million in 1959.

REGIONAL REPORTS

Ghana

Weather continues to be favourable for Ghana's 1959–60 *cacao* crop, which is expected to be even larger than the big 1958–59 crop. It is estimated at 590 million lb., while the 1958–59 crop was estimated at 575 million lb. In addition to good weather, the control of capsids through spraying and the fact that new plantings are coming into bearing support the higher forecast.

Alternating rain and sunshine have favoured good pod set and development of the crop. Harvest of the main crop will probably continue into January and February. *The Government's anti-capsid saturation spray programme, begun in 1956, is now showing good results.* Since July 1959 the programme has been the farmer's responsibility, but the Ghanaian Department of Agriculture shares a large part of the cost of spray and spraying equipment.

As cacao accounts for over 60% of the revenue that Ghana derives from exports, the Government will probably continue its efforts to expand production. The second development programme provides for continuing control of swollen shoot disease and capsids, distribution of improved planting material (improved Amazon types) and wider use of fertiliser.

Yugoslavia

Yugoslav *sunflower* seed production in 1959 totalled 137,700 short tons, up almost 50,000 tons from 1958. Harvested acreage was larger and yields were up because of adequate moisture most of the year.

Soya bean production – at 515,000 bushels – was double that of 1958, primarily a result of larger acreage. Efforts are being made to increase sharply the output of soya beans in order to supply edible oil and oilseed meals.

Australia

While still too early for a firm estimate of Australia's 1960 *hop* production, no more than an average crop of 3,800,000 lb. dry weight is expected. There are no indications of increased plantings. Actual production will depend on growing conditions up to harvest time next March–April.

The 1959 crop was a record of 4,106,000 lb. from 1,887 acres, mainly because of a bumper crop in Tasmania, the principal producing state.

Tobacco plantings late in the autumn totalled about 18,500 acres, compared with 15,000 in 1958. With the sharp acreage increase and favourable weather, the harvest in the early months of 1960 is expected to reach at least 16 million lb., compared with 13.9 million in 1959.

Lebanon

Lebanon produced 7.7 million lb. of *tobacco* in 1959 – 16% more than the 6.6 million lb. harvested in 1958. The 1958 crop was smaller than usual due to drought and civil disturbances.

The yield per acre was only 673 lb., compared with 781 lb. in 1959. Most of Lebanon's tobacco is Oriental type, although about 5% is dark air-cured.

England and Wales

The weather during December was very wet and stormy, with high winds reaching gale force at times. Early morning frosts occurred occasionally, but on the whole temperatures were above normal.

Fairly satisfactory progress was made with cultivations in most areas and field work was generally as forward as usual. On the whole, conditions were unfavourable for sowing, but, due to the good progress made previously, the acreage intended for winter corn had been sown in many areas.

Early sown *wheat* made good progress and later sown crops were germinating satisfactorily. *Barley* looked well, *oats* were strong and *rye* was vigorous and healthy. *Beans* were generally satisfactory, although backward in some areas.

Potatoes in clamps and stores were generally keeping well; some sprouting was reported. Satisfactory progress was made with the harvesting of *sugar-beet* and most of the crop was lifted. Roots were generally in good condition.

Acknowledgment is made to *For. Crops. Mark.* for much of the information contained in the above reports.